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The

Journal of Heredity

VOL. XV, NO. 1 JANUARY, 1924

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The JOURNAL OF HEREDITY is published monthly by the

AMERICAN GENETIC ASSOCIATION

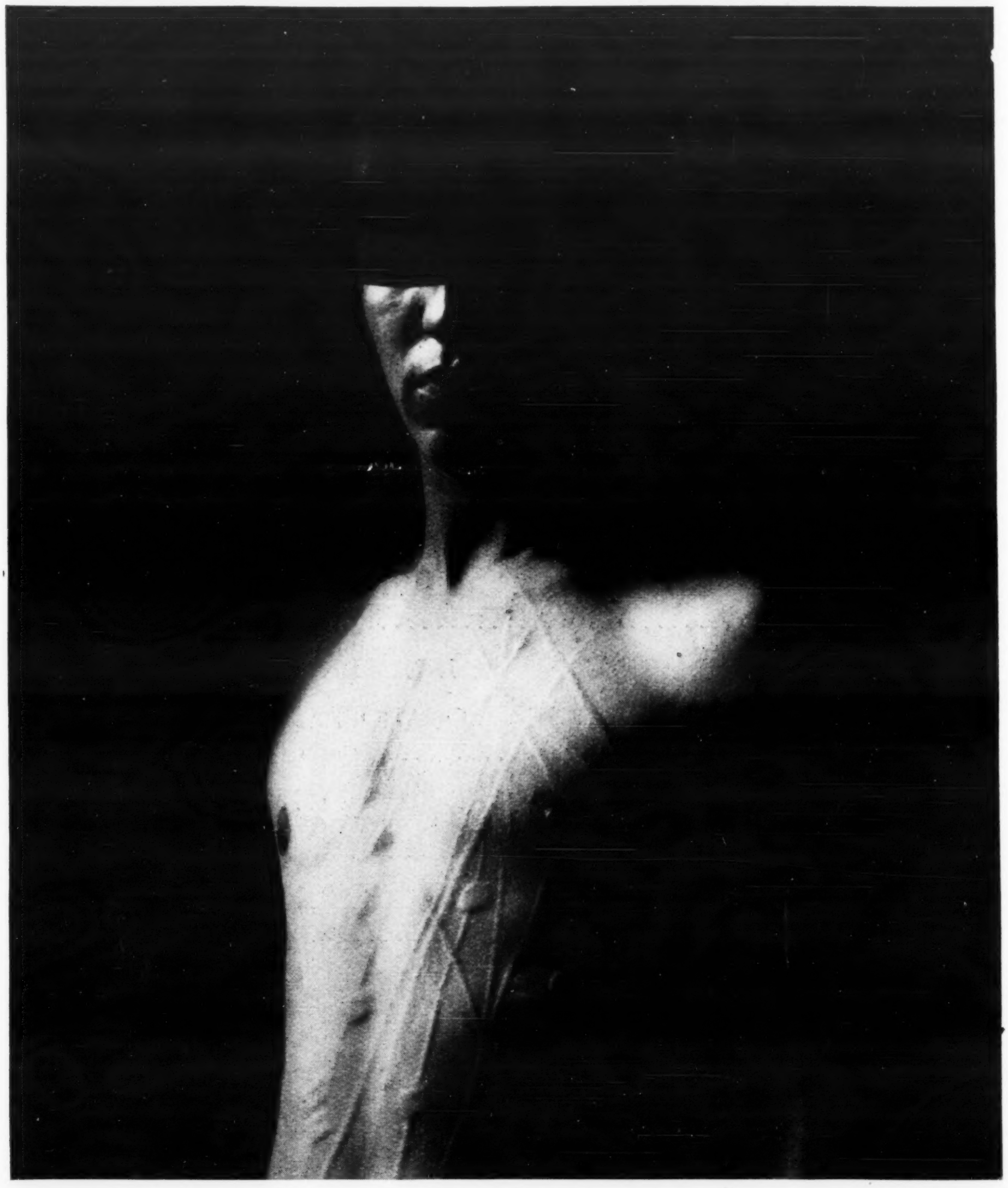
**At 1918-32 Harford Avenue, Baltimore, Md., and
Victor Building, Washington, D. C.**

Address communications regarding editorial matters and the business management of the Association to Box 354, Penna. Ave. Sta., Washington, D. C.

Entered as second class matter February 24, 1923, at the post office at Baltimore, Maryland. Acceptance for mailing at the special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized December 20, 1918. **Contents copyrighted 1924 by the American Genetic Association. .Reproduction of articles or parts of articles permitted only upon request, for a proper purpose, and provided due credit is given to author and to the JOURNAL OF HEREDITY, Washington, D. C.**

Date of Issue of this Number, March 5, 1924

$3.50 a Year, 35c the Copy



EVIDENCE OF A GLANDULAR DISTURBANCE THAT CAUSES CRIMINALITY

This boy's history is given on page 17. His mental development is normal, but he belongs to the adolescent criminal class because his endocrine glands have been upset by a bad environment. The welts and blotches on his body were produced by simply running the finger heavily over his skin, and snapping it with the thumb nail where the blotches appear. This is a symptom that the boy is suffering from a grave disturbance of the nervous system. Other evidence is given in the laboratory reports (Figures 3 and 4). Legally the boy is a criminal, and if left to himself or given the conventional treatment accorded such unfortunates, it is certain that he would continue to be a menace to society. Medically he is suffering from a grave disturbance of the endocrine glands that can be definitely diagnosed and treated with every prospect of affecting a cure. Instead of the inhumane and expensive method of keeping him confined, he can be made a self-supporting and useful member of society. While no definite figures are available, it is probable that a third of the convicts now confined in prisons in this country are suffering from emotional instability caused by glandular or toxic disturbances. These men are really patients for medical treatment, and not offenders who should be punished. (Frontispiece.)

BEHAVIOR AND GLAND DISEASE

Through Knowledge of the Gland Functions Many Defectives May Be Normalized

MAX G. SCHLAPP

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(Copyright, 1924, by Max G. Schlapp.)

"AS a man thinketh in his heart, so is he," says the maxim.

Since the Biblical proverb has already undergone considerable adaptation in achieving this wording and interpretation, it may not be unpardonable to revise it in conformity to recent science. Accordingly we may suggest, without disrespect, as a man functioneth in his neurons, so is he.

Nor does this paraphrase involve any serious negation of the original notion, for function lies behind thought and controls it. Instead of denying the influence of human thinking upon human conduct or character, this writer is set out to explore the mechanics and chemistry of that nervous process commonly called mental or brain activity and to determine in just what way individuality is established and infinite variety created among creatures of the same kind. We shall try to understand the causation of human defects and perfections and to catch a glimpse of the profound processes which bring them about. If full achievement is denied us, we plead the excuse of unconcluded labors in a field of vast expanse and but newly brought under study.

In the preceding article the attempt was made to show the effects of endocrine disorders in the mothers upon children generated while such disturbances were affecting her. Our attention was there confined to the evil influences of such disease conditions upon the formative activity of the living cells in the child, as manifested by the absence, deficiency or malformation of various vital organs, particularly the central nervous system (brain) and the ductless glands. What we arrived at was, in the simplest terms, that gland troubles in the mother cause the birth of various types of mental deficients and monsters, since such disorders inhibit or exaggerate the growth of the cells which make up the human foetus.

From this beginning, I propose now to proceed to a consideration of deranged functional processes in the living cells and their consequences to the human individual and to human society. Perhaps it is as well to remind the reader again that the cell has three activities — nutritive, formative and functional. We shall be concerned almost exclusively with the last process here, but it is well to remember that in certain individuals the formative and functional activities of certain cell groups may both be involved.

Without pausing at this point to explain the inwardness of the matter, let me set down at once the fact that disorders of this functional acitvity of the cells in man are responsible for the existence of unnumbered individuals who are in greater or lesser degrees deranged from the normal, unable to adapt themselves to the environment in which they must live, misfits in this world of ours.

To enumerate various groups in the ascending scale of gravity is a simple thing. Economic failures, social and family failures, vagrants and confirmed wanderers, irresponsible radicals of either progressive or reactionary

coloration, eccentrics and hermits, pathological liars, incorrigibles, false impersonators, phobiacs, inverts, homosexuals and finally, most criminals belong to this great family of beings miscast for the roles of life.

The contention is that many of these unhappy individuals are, with such exceptions as noted in my preceding article, the result of chemical disbalance in the blood of the mother. If, as I contended in my previous writing, the formative activity of the cells in the child may be disturbed by focal infections, the drain of infectious diseases, extrinsic poisons, such as narcotics, alcohol, and others, and particularly by gland disorders in the mother, these statements are also to be accepted in the case of functional disturbances. That is to say, outer and inner poisons and endocrine maladjustment in the female parent may not only cause cells of the child to grow badly, but in addition often lay the foundation for future functional disorders. Hence mental defectives of either formative or functional types frequently are the offspring of women suffering from slight or grave diseases of these all-important secretory glands.

The meaning of the words functional disturbance as here used is a derangement of the working or performance process in the cells of the nervous system and the controlling glands.

Such functional and even some formative ills in a child may not be observable at birth or during infancy. In a majority of cases there is, perhaps, some manifestation in this early period, but in other cases, particularly of functional derangement, the faults may defy detection until a much later period, when they make their appearance in answer to various evil stimuli.

Sometimes, though rarely, these maladjustments are revealed as the result of attacks of infectious diseases, such as scarlet fever, measles, and the like, though it is not always certain in these instances that the disease has not of itself destroyed or injured one or more of the glands or part of the nervous system. Again, the various focal infections may cause the faults to appear. More often, emotional shocks and deleterious environmental changes bring out of an individual the evidence that disorders of the kind described are present. Finally, adolesence, with its strains, its emotional ferment, its frequent maladjustment of the working balance of the endocrine system, often forces the fact of formative or functional derangement on our attention. One has only to note the instability, eccentricity and excitability of boys and girls at this crucial stage of life to realize that here if anywhere the flaws in the warp of the human fabric are most likely to be observed.

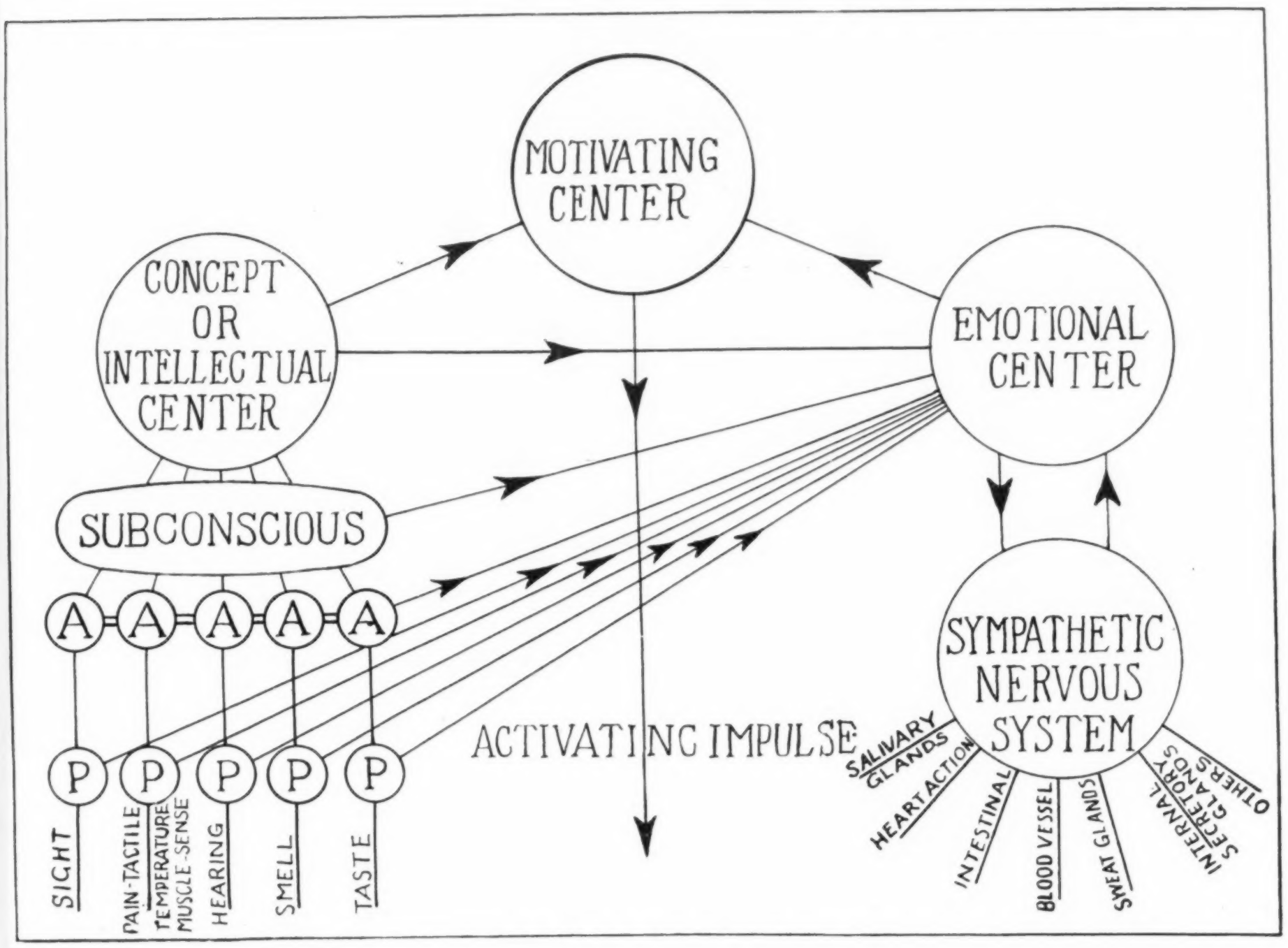
Value of Early Treatment

For the physician and the parent, it is of the highest importance to note that such functional disturbances must be treated immediately upon their discovery, quite as in the case of formative troubles. Functional disorders of the ductless glands are progressive. Bad hormone balance irritates the nervous system, which in turn further upsets the glands, with the result that they proceed to function still more abnormally with added injury to the neuron groups. This vicious circle of disease causes all types of functional disorder to progress eventually to a state of fixation, and at present the treatment of individuals in whom such ills have arrived at the chronic or established point does not always bring results. The fault in many cases is likely to be beyond rectification.

But what are these errors of creation, these blunders of nature, these functional derangements? And above all, how do they make men better or worse, strong or weak, brilliant or dull, tender or brutal, sane or mad, social or criminal?

The Nervous System

For the better understanding of the lay reader it may be necessary to explain briefly the makeup of the human nervous system and the manner in



MECHANISM OF THE BRAIN

FIGURE 1. Chart to show the impulses generated in the human brain by a percept entering through one of the sense organs. An external stimulus reaches the brain through the percept center (P), in the occipital lobe. From there one impulse travels to the association center (A), and another to the emotional center. Arrows indicates the paths of the other impulses (see page 9).

which its various parts proceed with their work. Our nervous equipment is constituted of groups of cells which, connected by their various fibres, form the numerous and marvelous neuron systems, each with its special labors to perform. Accordingly, we have the motor systems which control physical acts and activities; the special sense systems of seeing, hearing, touch, taste, and so forth. Much deeper and far more mysterious than these are the association systems and the systems in the concept center, where images or other stimuli from without unite with the stored grain of memory to form ideas or conceptions; or the various neuron systems in the emotional center, where the darkest passions and highest feelings of men are kindled—hatred and affection, ferocity and pity, blood lust and loving kindness.

Just as these various neuron systems have disparate offices to perform in the life of man, so, too, are they vulnerable to a variety of enemies. Of these foemen some may be quite impotent against certain cell groups or systems and quite deadly to others, and still other attackers may be disastrous to the first kind of nerve cells and have no effect on the latter. To state the matter technically, cell groups or systems are selectively affected and their functional activity disturbed by various extrinsic and intrinsic poisons and especially by a subnormal or supernormal presence of any of the endocrine hormones.

All nerve cell groups and systems

are constituted, of course, of the individual cells with their axis cylinders and dendrites. These vital specks of protoplasm we must look upon as minute storage batteries which take up from the surrounding lymphatic medium in which they swim their nutrition and then transform this food into potential energy, stored within themselves against the moment of need. We have already seen in my earlier article how the amoeba proceeds with the same activities in its medium, the water of the sea, and how either deleterious chemicals, too much or too little salt or even too high or low temperatures will destroy the amoeba. Quite the same thing is true of the human medium in which the nerve cell floats.

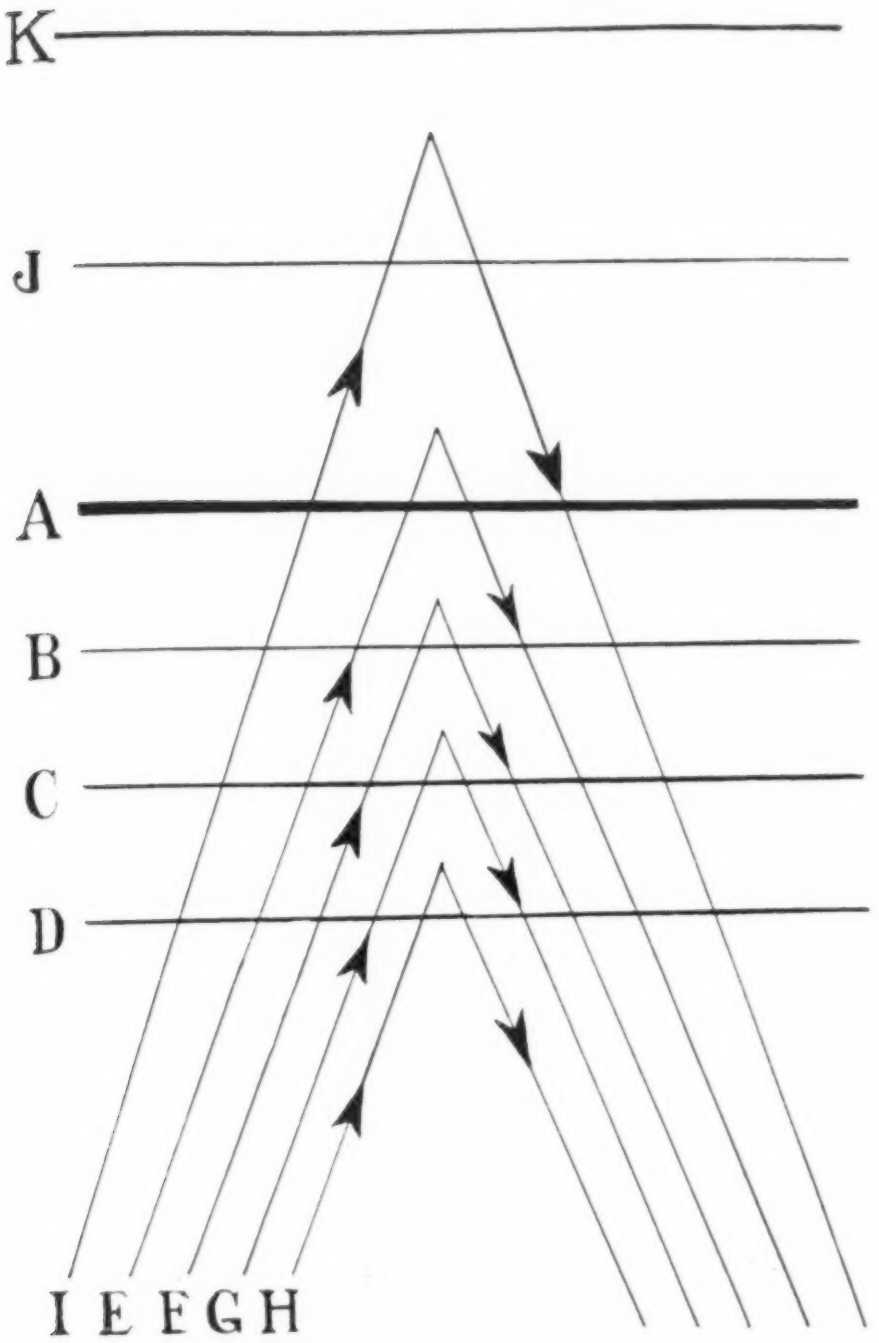
If this medium contains the normal proportion of all the necessary hormones, and nutritive substances, anatomical structure being normal, it will be a healthy cell and give normal responses to stimuli. On the other hand, if there is a particle of drug in the medium, as in cases where the human being is afflicted with narcotic or alcoholic addiction, or if the patient is suffering from an infectious disease or focal infections such as occur in the bowels and teeth, the toxins of these disorders will be present in the medium and certain of the cell groups as well as their functional activity will be damaged thereby; others not at all. We must repeat here, that disturbance of the internal secretory glands, owing to shocks, strains, changed environment and the like, is the far more frequent cause of such damage to nerve groups and centers. The over-abundance, shortage or absence of any of the hormones of these glands will affect various neuron systems in fixed ways, each set of nerve groups being affected by a different kind or degree of hormone disbalance in the vital medium.

Let us consider for a moment what this means. The hormone of any one of the glands or several or all of them may be deficient or over-abundant in infinitely varying amounts. The blend may be near to or far from perfection in almost endless degrees. Just so, few or many of the neuron groups may be affected slightly or seriously, again in unending variety. And through their comparative health or lack of health the individual will be higher or lower, finer or coarser, normal or abnormal.

Here we come near to grasping the key to human character and personality, surely one of the darkest of all time's tyrannous secrets. Are we about to plumb the mystery of human conduct and disclose the underlying causes of the differences in human character? Without being either egregious or sweeping, the positive answer must be given. We are still far from understanding the chemical basis of many of our activities and actuations, but the formula of many others is already in our grasp.

We have seen how neuron systems may be disordered by the presence of toxins or hormone disbalance in the lymphatic medium, but we have yet to see how this disorder may abnormalize our conduct. To proceed this step further it is essential to understand that there is a definite point at which the potential energy in a nerve cell can be exploded and sent forth in the form of kinetic energy—nerve impulse, in other words. This point is the threshold of functional activity. Any impulse coming from without which is not strong enough to explode any of the potential energy in the nerve cells simply falls below the threshold of functional activity—the explosion point. Nothing happens. Any stimulus strong enough to explode such energy reaches or rises above the threshold. Then things do happen. What kind of things will be determined by the strength of the incoming impulse. If it is comparatively weak it will explode but little potential energy. If it is strong a great amount of the stored forces in the cells will be exploded, and the fire spread to other neurons, involving even the remote centers.

To translate this into visual terms we must imagine the threshold of func-



THRESHOLDS OF FUNCTIONAL ACTIVITY

FIGURE 2. An impulse of a certain definite strength is required to "explode" the stored energy in a nerve cell, and under normal conditions the strength of this impulse is fairly constant. This condition can be visualized in the above diagram, where the line A represents the normal "threshold" of functional activity. The impulses, I and E, are strong enough to produce a reaction, but the weaker impulses, G and H, have no effect. Pathological conditions and certain poisons result in the raising or lowering of one or more of these "thresholds." When the threshold is lowered (B, C, D), very slight impulses produce a reaction, or it may be raised so high that the strongest impulses will produce no effect (K). Ether and chloroform raise the threshold of the conscious centers in this way, and are accordingly used as anaesthetics.

tional activity to be a kind of dam above which the impulse must rise before an outgoing impulse can flow off. The accompanying drawing (Figure 2) will give one visualization of the process.

Under normal conditions this threshold is more or less stable. But if a poison or a chemical disbalance be present in the surrounding medium the cell plasm will be injured in various manners and degrees. It will become unstable or too stable. That is to say, certain toxic conditions and all forms of gland troubles, causing unhealthy hormone mixtures in the lymphatic fluid in which the cell lives, will render that cell either too sensitive to incoming impulses or not sensitive enough. When the plasm of the cell becomes super-sensitive it reacts to the slightest impulses, such as would normally cause no explosion of the potential energy. In such a case we say that the threshold of functional activity has been lowered. The dam is too low to hold back the normal flow of water. Oppositely, when the cell plasm has been made insensitive, the neurons will not function except under the most powerful stimuli and in some instances not at all. In that case we say the threshold has been raised. The threshold may, of course, be raised or lowered to any level, from a slight physiological raising or lowering, on to the extreme pathological heights or depths.

This raising and lowering of the threshold may be seen in familiar instances. Ether will raise the threshold or dam, in the conscious centers, so high that no percept can reach them. But ether, like all poisons and chemical disbalances, acts selectively. It does not interfere with the centers controlling the heart and lungs. Therefore the anaesthetized person lives though he be completely unconscious.

Again, the absence or shortage of thyroid hormone in the lymphatic fluid raises the threshold in other nerve centers and causes the person so afflicted to be dull, stodgy, demented. An overabundance of the same hormone will produce the diametrically opposite results. If there is only a little too much thyroid stuff in the lymph the person will be only slightly over-active, over-intuitive, restless and nervous. If the excess of this hormone be too great, on the other hand, the thresholds in the emotional and concept centers of the

brain will be deeply lowered and we shall have emotionally unstable individuals, phobiacs and the like.

That terrible drug, cocaine, acts complexly, lowering the threshold in certain neuron groups and raising it in others. In the emotional and motor centers the dam comes so far down that the addict is likely to commit the grossest crime. Yet the same cocaine may be administered as a local anaesthetic, since it paralyses the end bulbs of the sensory nerves, or raises the threshold in the sensory end organs.

But to proceed with our exploration of the chemistry of character and the mechanics of behavior. In every human being there are infinite numbers of neuron groups, the total varying greatly, however, according to the individual. The high type of man owns many more such groups than the common individual and vastly more than a person suffering from a formative type of feeblemindedness. Again, not only the number but the quality of neuron groups must be calculated. If we may postulate an ideal man, mentally, he must be an individual possessing the largest number of neuron groups, all of them in complete health and so attuned, each to all the others, that perfect nervous harmony will exist. Such a man would react brilliantly, judiciously and normally under all circumstances and environments. He would, indeed, be a creation beyond the superman.

In a person of this perfection the threshold of each and every neuron group would be precisely normal, in sense of greatest efficiency. That no such fabulous creature exists or could exist, we may be tolerably certain. No human being may hope to defy the forces of constant evolutionary change, vast environmental mutations, the strain of living and struggling and the ravages of the years.

But there are men in whom only a few of the thresholds are disturbed. In these we have the prime specimens of our kind. There are others who are more disturbed in certain trends, a larger number of neuron groups being involved. Such men may be prodigies with amiable or evil weaknesses, one-sided geniuses and the like. For obvious example, let us take the otherwise efficient, sane, refined man, who is subject to sudden rages, which may quite sweep away his self-control and in extreme instances lay him open to the rashest of acts. We know beyond further question that the thresholds are low in the anger-emotional center of his brain.

Again, we find the man who is thoroughly honest, upright, law-abiding, decorous and in harmony generally with his social environment, except in the matter of sex. I suppose no one need be reminded of the limitless gradations of sexual aberration, from the man who violates natural morality in some slight and unimportant degree, down to the even more common exhibitionist, the invert, Masochist, Sadist —the Jack-the-Ripper.

But if the endless variations in the thresholds of the neuron groups account for the behavior of human beings —for their mental characteristics—it is also a fact that outward characteristics or physical appearance are also controlled in this manner. No two men are quite alike to the eye or to technical measurement because no two sets of glands and neuron groups are ever adjusted in precisely the same way.

The extent to which gland disturbance and the consequent maladjustment of the neuron groups affect appearance may be seen most obviously in any clinic, but not less clearly to the practiced eye on the streets, in the shop, the office and the home. Microcephals always look unmistakably alike. Another type of unfortunates is so uniformly of the same cranial and facial character that it has been named from its outward appearance, the Mongolian idiot. But we know with equal clarity that the woman who just passed us, striding with quick nervous movements, wide eyed, over eager, a little too tense, is gifted or afflicted, as the case may be, with a little too much thyroid activity. Yonder man, with his soft flesh, his

slow indolence and general hebetude is certainly disturbed in his pituitary and we know his characteristic appearance so well that he has been classified as the pituitary type. As a matter of course, the shading goes down to infinitely finer differentiations than this. The very carriage, manner, walk, general physical behavior, eyes, muscular control, shape of legs, arms, torso, the peculiarities of enunciation even, all tell us clearly of the inner balance or disbalance of the individual.

So, once more, the man is what his neuron function makes him both without and within.

Effect of Memory Content on Behavior

Having come this far, it is imperative to note, however, that another factor intervenes to affect behavior in man. We speak of the memory content, in other words the stored up concepts in the brain of every sapient individual. What these concepts are and how they are formed and retained needs next to be made clear.

Let us say, for illustration, that our subject sees an apple. An impulse travels from the retina of the eye to the percept center in the occipital lobe of the brain. Here some potential energy of the cells is exploded and the impulse caused by the sight of the apple travels to the association center. The subject now remembers the general associations that belong to the apple—its smell, taste and touch, even the sound of its falling. Next there flash automatically into the picture great numbers of secondary associations. A few stand out or are brought up out of the subconscious. For instance, the subject may recall vividly some event closely or distantly connected with an apple. The memory content seems to project itself into the process just at this point, when the impulse has caused a reaction in the cells of the association center.

Let us assume that the subject remembers having given an apple to an old sweetheart. At the time she laughed and ridiculed the gift. Immediately there comes into the higher concept center the idea of something embarrassing and ridiculous, consequently, there is awakened in the emotional center a wave of pleasureable feeling which meets a wave of unpleasant emotion awakened by an impulse from the concept center, where the idea of the old unhappiness and pain has been revived.

The concept center is the point in the brain mechanism where percepts coming from without meet with associations and memories, to be digested into a complex mental image. In the case of the apple, the concept will be a complete instantaneous review of all the matters previously recounted, together with an intellectual analysis and conclusion.

This picture and conclusion will be stored in the cells of the concept center as memory, to be frequently or rarely reawakened. It does not follow that the same old concept will be reformed every time the subject sees an apple. The circumstances under which it is seen, the responsiveness of the man at the time and other factors will cause variations. Yet, by way of a mechanical illustration, it is probably a fact that precisely the same concept will be called forth again every time the same cells are exploded. Thus, theoretically, if an impulse reaches Cell 997, Cell 10,763, Cell 13,458, Cell 324,765, and Cell 543,234, a certain fixed concept will be roused and every other impulse that reaches just these cells and no others will continually arouse precisely this same concept—the same memory.

It is worth remarking here that, whether we are aware of it or not, a wave of emotion, slight or strong, accompanies every percept and concept. We feel whenever our brain acts. There is apparently no such thing as emotionless activity of the mind. What is true is that the emotional functioning is often so slight that we are not conscious of it. Nevertheless, it is always present and it is this overtone of emotion in everything our brain does that

gives to life its color and glow, its shades and symmetries.

At this point we must return to our consideration of the thresholds of functional activity. We have already seen that an impulse coming in through the sensory gateway must be of a certain fixed strength to cause an explosion of the nerve cells in the normal person and that when the impulse is strong enough to have caused this activity it is said to have reached or passed the threshold. We have also seen that gland disturbance and the ensuing disbalance of the lymph in which the cells live will cause this threshold to be greatly raised or lowered.

The emotional center of the brain is constituted of many cell groups which control such feelings as anger, fear, sex, grief and many others which have not yet been named because we do not understand them. In these groups of cells, as in all others, the thresholds may be lowered or raised by the selective action of poisons and hormone disturbance. Again, they may be raised or lowered to varying levels.

Let us take a case of anger. When Mr. Jones was in good health he did no more than explode a little profanity when his wife quarreled with him and stung him with reproaches. But Jones has been attacked by a severe case of endocrine imbalance, (hyperthyroidism and suprarenal over-activity), the disease has expressed itself in a distinct lowering of the threshold in the anger-emotional center. (This means, of course, that the cell plasm in this particular group has been over-sensitized.) Now, when Mrs. Jones lets loose her tongue lashing, her sick husband seizes the nearest chair and crushes her. The depression of the threshold in his emotional center has brought him to what I have named the point of Pathological Action. He is a murderer. Should he be held responsible for this murder? Being a mentally sick individual, it was impossible for the patient to control this act. Therefore, I feel that he was decidedly irresponsible. When the point of Pathological Action is reached the individual is no longer able to control himself, to master his emotions, to check his actions. He is as definitely irresponsible for the time being as any maniac. It is probably true that the point of Pathological Action is never reached in a thoroughly normal being.

Because there has not yet been afforded either time or means for the necessary experiments, studies and explorations, it is not possible to speak with too much precision in dealing with the stage of excitement or the pathological circumstances under which the point of Pathological Action is likely to be reached. What we do know, from thousands of clinical studies, is that a very large number of criminal acts are committed by persons suffering from gland and nervous disturbance and that such sufferers are, at the time of their offenses, irresponsible. Thus the old-fashioned plea of temporary insanity, which has figured in so many court dramas, is amply supported by the clinical facts. Temporary irresponsibility, probably is a more accurate term, however.

One of the results of clinical study of these cases is the conclusion that feebleminded persons and others with poorly equipped intellectual centers react much more readily to all sorts of evil stimuli and naturally lack self-control. It is well known that cocaine poisoning will cause certain low types of men to commit the gravest outrages, especially after they have become addicted, because it causes a sharp lowering of the emotional thresholds, robbing the individual of all caution and self-control. But if a normal man of education and culture happens to become poisoned with cocaine, through over-dosage in a surgical case, let us say, he is very unlikely to break the law or even the conventions. He also is unlikely to fall a victim to the drug habit. His thresholds in the emotional centers are lowered, though perhaps not so markedly as those of the other type of man. He feels a nervous anguish, an intense excitability and

fearful restlessness. He is in torment until the effect of the drug passes from him, but it probably never occurs to him to express his excitement in unlawful acts. Such concepts have simply not prevailed in his intellectual center.

Here we must take account of the memory content, one of the determining factors of behavior. It must be obvious that the kind of concept that will prevail in one man will be altogether different from that of another. The number and character of experiences and conceptions stored in each brain must be slightly or greatly at variance with those in others. If a man's memory be full of violence, disorder, resentment and hatred he will commit criminal acts when his emotions flow over and carry him away.

On the other hand, if the man is a creature of culture and refinement, even the worst emotional explosions will not cause anti-social actions—except under extraordinary conditions. In disease as in health, the man of the gutter will behave according to his world and the man of the peaks in keeping with his. Nor does it make any difference whether the thresholds have been depressed by a drug or by gland disease. The former is only an artificial recreation of the latter.

The inherited or congenital types of emotional instability and feeblemindedness discussed in my first article are to be borne in mind here. Environment is by no means the sole factor.

Nevertheless the environment of the man, past and present, plays a controlling part in his behavior. Not only does his gland condition depend to a very great extent upon the circumstances under which he lives, (many cases of hormone disbalance and consequent nervous disorder being directly traceable to unhealthy environment), but the past conditions under which the man has grown and developed or failed to develop, will influence the immediate functioning of his brain mechanism.

The late war illuminated this point. Men went from their peaceful homes to training camps, where their minds were filled with concepts of hatred, violence, bloodshed and rapine. They were then transported across the seas to the battle areas, where sights of blood and horror were added to the stored concepts. The strain of campaigning, the fright and dread, the racking din of battle, the constant tension soon upset the glands and nerves of many if not most of these men. Consequently, we had endless cases of emotional instability afflicting men whose brains were stored with these evil concepts. It was, then, hardly a matter for wonder if many returning soldiers turned out to be violent criminals and came to grief in prisons and asylums.

Glandular Instability and Criminality

It is this emotional instability, due to lowered thresholds and intense responsiveness to external impulses, that explains behavior of a very large percentage of all criminals now confined to jails and prisons. Just what the proportions are it may be rash to estimate. Yet more than twenty thousand clinical cases studied from every angle, psychologically, neurologically, psychiatrically, physically, chemically and etiologically, many of them referred from the criminal courts of New York, especially the Children's Court, furnish at least some basis for rough estimation. It would not surprise the writer if investigation were to reveal that a third of all present convicts were sufferers from emotional instability, which is to say gland or toxic disturbances. This does not include feebleminded or insane people. It follows, if this be true, that a third of the men now being punished (not including the feebleminded or insane) are really patients for treatment, not offenders for punishment and it is also true that their troubles are, in many cases, amenable to treatment now fairly well understood.

A few representative clinical cases will be cited, to show the relationship between glandular disturbances and

REPORT ON BASAL METABOLISM Sekloff

Chart No. 20120 Serial No.

Clinic No. C - 1191 Date of Report 14-VI-23

Name Ward Ment. C1 Date of Specimen 11-VI-23 Age 15 Sex M

Details of test:

Height 165.5 cm. Weight 117 lbs. Surface area 1.58 square meters.
Duration of test 9.0 minutes.
Pulse 80 Respiration 26 Ventilation 8.2 liters of air per minute.
Respiratory quotient 0.83 Heat value of oxygen 4.838 cal. per liter.
Oxygen absorbed 288.8 cc. per minute.
Total calories per hour 83.86
Calories per square meter of surface per hour 53.08 (average normal 45.2).

RESULT: BASAL METABOLISM 17 per cent above the average normal.
(Normal variation from 10% above to 10% below the average.)

Gasometer method.
DuBois normal standard.
Test satisfactory.

CV Bailey
Cameron V. Bailey, M. D.

Form No. 154-3-29-23 Lab. No. 12204

LABORATORY PROOF OF GLANDULAR DISTURBANCE

FIGURE 3. This report, and those that follow, give the results of laboratory tests of two boys with criminal tendencies, whose histories appear on page 17. One is suffering from an over-active thyroid gland, and the other from a deficiency of thyroid secretion, and other glandular involvements. Though their behavior is somewhat similar, the underlying causes are quite different, and different medical treatment would be necessary. Legally both are criminals, who would receive the same punishment, which would cure neither.

criminality, and, at the same time, to establish the effect of such disorders upon behavior generally. The lay objection that normal and abnormal behavior are not cognate and, hence, that reasoning derived from studies of abnormality is not cogent when applied to the normal, may be dismissed at once as dilettante and unscientific. Similar effects imply similar cases. Variations in degree do not alter this ancient fact.

Case 1. James Blank, a young man of eighteen or nineteen, served as a sailor in European waters during the war. His boat was attacked by submarines and he suffered from shock with the result of marked emotional instability thereafter. At the close of the war he was employed by a firm of brokers in Wall Street, with whom his alertness, energy and bearing made a very favorable impression.

The employers were not aware of two strains under which this agreeable but unstable boy was laboring. He was the sole support of an invalid mother, and, his earnings being small, the economic struggle was intense. In addition, the boy was being constantly beset by one of the large family of financial district jackals whose business seems to be to corrupt young men for their own money advantage. This person was a market tipster of the lowest order. He constantly besought young Blank to use some of his firm's money for a sure-thing speculation that would make him prosperous in a few hours. Under the circumstances, the temptation was great and the unstable boy eventually yielded.

One day he was sent to the bank to get a thousand dollars which was to be used by one of the firm for traveling expenses. Instead of returning with the money, he turned it over to the tipster and promptly lost it. Blank then resorted to his employers and confessed. The brokers were so fond of him that they decided to retain him in their employ and permit him to pay

Chart No. 20126 **REPORT ON SUGAR TOLERANCE TEST** Serial No. Schlapp

Clinic No. C 1191 Date of Specimens 6-11-23 Date of Report 6-12

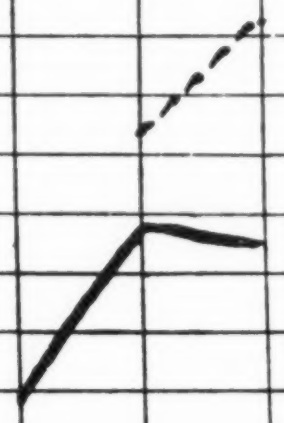
Name _____ Ward Mental Weight 118 lbs Age 15 Sex M

Clinical Diagnosis _____ Carbohydrate Given Glucose Gms. 93.8 Time _____ Fluid 208 cc.

Time	Blood Sugar	Urine Volume	Urine Sugar	Urine Sugar
	per cent	cc.	per cent	mg.
1	0.112 Glucose	no specimen		
2	0.230	300	0.36	1080.
3	0.222	120	1.19	1428.
		Total		

Blood Sugar per cent
0.36
0.32
0.28
0.24
0.20
0.16
0.12
0.08

Hour · Blood ——— Urine ·····



Urine Sugar mg.
1400
1200
1000
800
600
400
200
0

Remarks _____ J K Killian

Lab. No. 12019

FORM 77 6-16-22

REPORT ON CHEMICAL EXAMINATION OF BLOOD

Clinic No. 20120 Serial No. Schlapp

Clinic No. C 1191 Date of Specimen 6/12/23

Name _____ Ward Mental Date of Report 6/13/ Age 15 Sex M

Volume obtained _____ cc

Total Solids _____ per cent

Hemoglobin _____

Total Nitrogen _____

NON-PROTEIN NITROGENOUS CONSTITUENTS mg. per 100 cc.

Non-protein N _____

Uric Acid 4.3

Urea N 15.0

Creatinine _____

Creatine _____

Amino Acid N _____

MISCELLANEOUS CONSTITUENTS per cent

Sugar 0.112

Diastatic Activity _____

Cholesterol _____

Fat _____

Acetone Bodies _____

Chlorides as NaCl 0.500

Calcium as Ca _____ mg. to 100 cc.

Inorganic Phosphates as P _____

CO_2 Combining Power _____ cc. CO_2 per 100 cc. plasma

Oxygen _____

REMARKS

J K Killian

Form No. 118 C. P. Co.

Lab. No. 12029

REPORTS OF LABORATORY EXAMINATION OF GUISEPPI ——

FIGURE 4. Compare the sugar tolerance curve and the report on basal metabolism (Figure 3), with those for another boy of criminal tendencies, shown in Figures 5 and 6. In this case basal metabolism is seventeen per cent above normal, and in the other fourteen per cent below. This boy's photograph is shown in the Frontispiece, and in Figure 7.

back the stolen thousand dollars in small weekly installments, to be taken from his salary.

This plan further reduced the slender income on which the boy and his mother had to live. Actual privation was perhaps not great, but the young man's worry and anxiety increased constantly. His excitement augmented with every day. This instability had originally been due to the emotional shocks suffered in course of the war. It was heightened by present stresses. Worry and care caused his already dis-

REPORT ON BASAL METABOLISM

Chart No. 27439 Serial No.
Clinic No. 19148 Date of Report 20-XI-22
Name L Ward Mental Cl Date of Specimen 16-XI-22 Age 12 Sex M

Details of test:

Height 142.5 cm. Weight 119.5 lbs. Surface area 1.42 square meters.
Duration of test 14.0 minutes.
Pulse 75 Respiration 21 Ventilation 55 liters of air per minute.
Respiratory quotient 0.74 Heat value of oxygen 4.727 cal per liter.
Oxygen absorbed 224.9 cc per minute.
Total calories per hour 63.80.
Calories per square meter of surface per hour 44.93 (average normal 52.2).

RESULT: BASAL METABOLISM 14 per cent below the average normal.
(Normal variation from 10% above to 10% below the average.)

Gasometer method.
DuBois normal standard.
T est satisfactory.

C.V Bailey
Cameron V. Bailey, M. D.

FORM 35 9 27 22 Lab. No. 5544

THE BASAL METABOLISM OF LOUIS ——

FIGURE 5. For his history, see page 17 (case 3). On the basis of these reports and other examinations, it was possible to bring about such a complete change in the boy's behavior that his teachers believed he was under the hypnotic influence of those who were giving the treatment. Notice that his basal metabolism is fourteen per cent below the average normal.

turbed glands to function even more abnormally. The chemical balance of his blood and lymph was more and more gravely disturbed as his excitement progressed. Finally, he arrived at a distinctly pathological condition—walking the floor all night, mumbling and murmuring to himself, rejecting food, remaining away from his work.

At this time the New York newspapers were full of the accounts of successful holdup crimes along Broadway and in other parts of the city. The young man learned from the papers how bandits had calmly walked into shops, restaurants and factories, seized large sums of money and got away without trouble. Naturally, the concept of imitating them and thus relieving his own economic situation formed in his disordered mind.

One morning, after having walked the floor all night and refused food at breakfast time, he wandered aimlessly out of the house and down the street. In front of a garage he picked up a piece of pipe, which he hid under his coat. Proceeding aimlessly down the street, he passed in front of a pawnbroker's shop, where he saw some jewelry and a number of Liberty Bonds displayed in the window. The idea that he might rob this man came to him and he entered the shop. At that moment the telephone rang and the solitary broker went to the rear of the store to answer it, turning his back to the boy.

Blank immediately slipped toward the unsuspecting loan broker, struck him a heavy blow over the head with the pipe and felled him.

But now, instead of carrying out his original intention, the boy exhibited the characteristic faults of the emotionally defective. He dropped his pipe, quaked and trembled with released excitement, and was unable either to cry out or to leave the spot. He made no attempt to seize the bonds or jewels. Neither did he make an effort to run away. Indeed, he could not have

A. Schlapp

Chart No. 19148 **REPORT ON SUGAR TOLERANCE TEST** Serial No.

Clinic No. 27439 Date of Specimens 11/22/22 Date of Report 11/24/22

Name Ward Mental Weight 54.8 Kg Age 12 Sex M

Clinical Diagnosis Carbohydrate Given glucose Gms. 95 Time Fluid 248 cc.

Time	Blood Sugar	Urine Volume	Urine Sugar	Urine Sugar	Blood Sugar	Hour	Blood	Urine				Urine Sugar
						1st	2nd	3rd	4th	5th	6th	
	per cent	cc.	per cent	mg.	per cent							mg.
I	0.112	125	0.05	37	0.36							1400
glucose					0.32							1200
II	0.147	29	0.24	69	0.28							1000
III	0.164	11	0.21	23	0.24							800
					0.20							600
					0.16							400
					0.12							200
		Total			0.08							0

Remarks J. A. Killian

Lab. No. 5857

Dr Schlapp

REPORT ON CHEMICAL EXAMINATION OF BLOOD

Clinic No. 27439 Serial No.

Chart No. 19148 Date of Specimen 11/22/22

Name Ward Mental Date of Report 11/24/22 Age 12 Sex M

Volume obtained cc.

Total Solids per cent

Hemoglobin

Total Nitrogen

NON-PROTEIN NITROGENOUS CONSTITUENTS mg. per 100 cc.

Non-protein N

Uric Acid

Urea N 9.7

Creatinine

Creatine

Amino Acid N

MISCELLANEOUS CONSTITUENTS per cent

Sugar 0.112

Diastatic Activity 15.4

Cholesterol

Fat

Acetone Bodies

Chlorides as NaCl

Calcium as Ca mg. to 100 cc.

Inorganic Phosphates as P

CO_2 Combining Power c.c. CO_2 per 100 cc. plasma

Oxygen

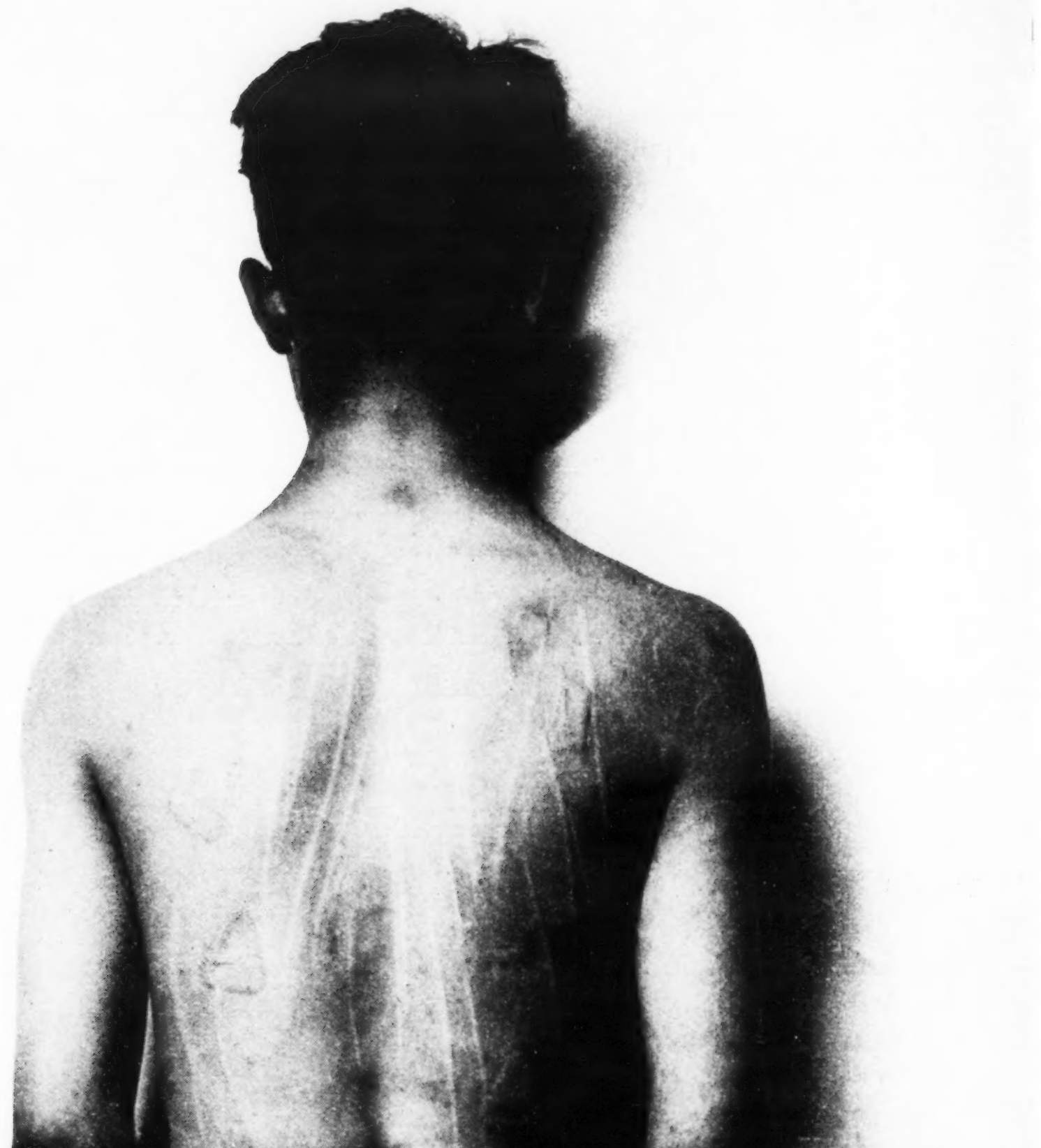
REMARKS

J. A. Killian

Lab. No. 5856

REPORTS THAT DETERMINE THE CAUSES OF CRIMINALITY

FIGURE 6. For descriptions of these see the text and legends to Figures 3 and 5. Such laboratory examinations make it possible to determine the causes of criminality, which by proper treatment can often be removed, making the potential criminal a normal and useful member of society.



WELTS CAUSED BY NERVOUS DISTURBANCE

FIGURE 7. This boy's history is given on the opposite page (case 2). Family misfortunes and the excitement caused by frequently attending thrilling moving pictures upset the balance of his ductless glands, lowering the "thresholds" in the emotional centers of his brain, so that he was unable to resist his impulses. The moving pictures also undoubtedly furnished some of the damaging concepts that resulted in antisocial behavior.

moved had he tried. The emotional explosion had robbed him temporarily of the necessary muscular control. He was easily captured where he stood and taken to jail. When his case came up for hearing, the judge referred this prisoner to me for examination.

The carbohydrate tolerance test showed a high pathological curve, indicating a grave disturbance of the endocrines. He was, in fact, suffering from a pluri-glandular involvement. He was put on treatment and a second test, made some months later, showed him to be practically normalized. This young man, if forced to adhere to regular and constant treatment over a relatively short period of time, would unquestionably be quite redeemed. Even as he responded when I last ex-

amined him, the likelihood of further criminality on his part was, in my judgment, negligible.

Case 2. Giuseppi ——, a young South Italian, brought to this country in his infancy (Figure 7). This boy belongs to the adolescent criminal group, being at present fifteen years old. The boy is intellectually sound and was formerly bright enough to make seven terms in the grade schools in the time allotted for four. His teachers spoke of him as being exceptionally brilliant.

At the age of fourteen, however, a change came over him. At this time his father and mother were both ill, family finances were at a low ebb and the young boy worried intensely. He became upset emotionally, paid no attention to school or studies and his teachers found him actually dull. He now began to play truant and to steal. When caught at one of his misdemeanors he announced that he wanted to go to prison for life and repeated that the idea of stealing and running away had come into his mind suddenly and that he felt it would come again.

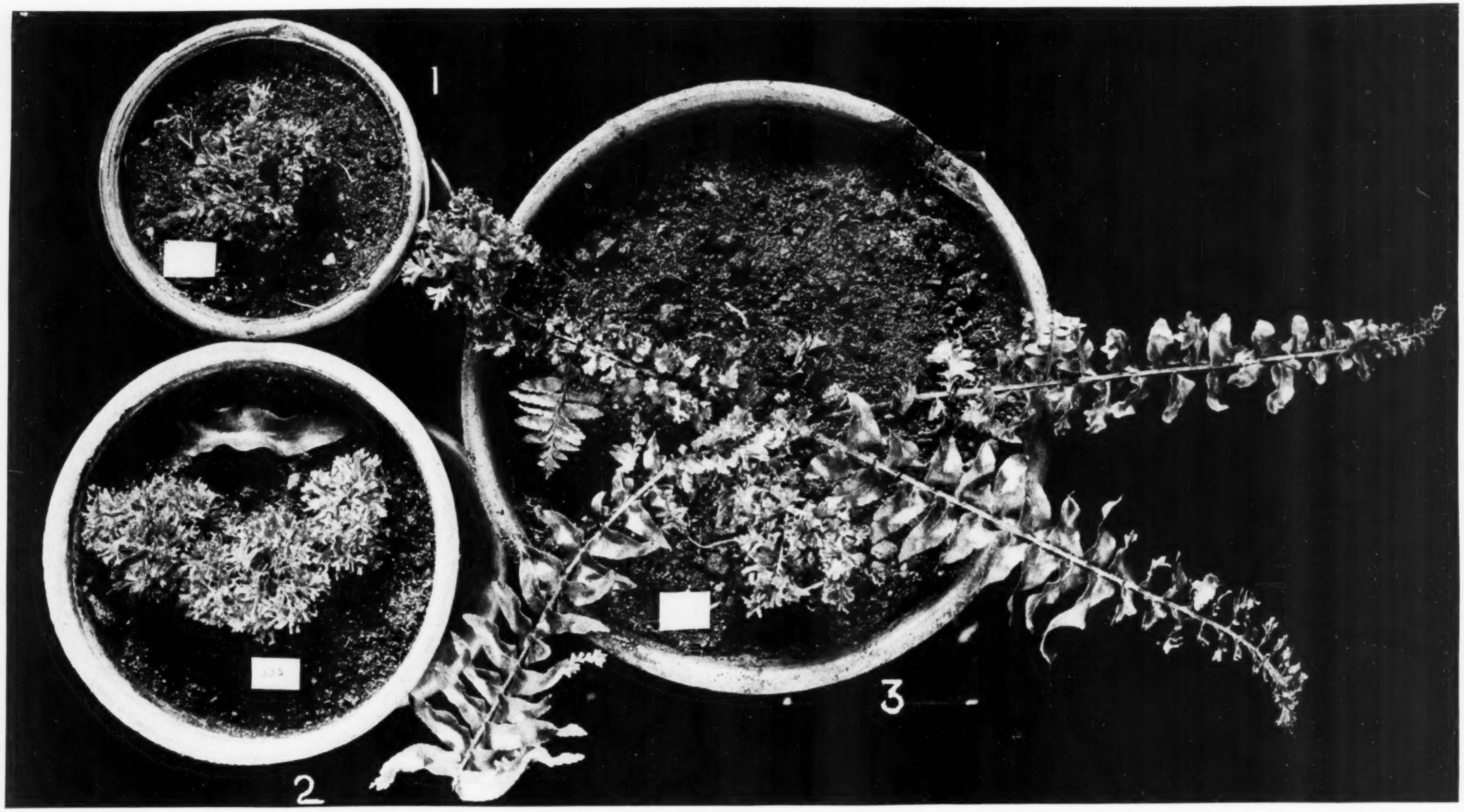
This boy attended thrilling motion pictures three or four times a week and some of his damaging concepts were undoubtedly gotten from these harmful and dangerous exhibitions. Guiseppi stole money with which he bought a cowboy suit and dressed himself up as one of the characters in a movie he had witnessed. He ran away from home in this garb, went to a cheap hotel and registered as a well-known moving picture actor.

The degree to which this boy is disturbed may be judged from the photograph, which shows his body streaked with long welts and blotches which were produced by merely running the finger strongly over his skin and snapping the skin with the thumb nail. This condition indicates a serious vasomotor disturbance. Laboratory investigation revealed that the boy was suffering from over-activity of the thyroid, suprarenal and pituitary glands. The threshold in the emotion center was greatly depressed and he was therefore without power to resist the emotional waves connected with the evil concepts with which his mind was filled. This situation is being corrected by treatment.

Case 3. Louis ——. This boy is afflicted with formative as well as functional disturbance—a Froelich's syndrome with slight intellectual deficiency. The gonads are not developed and parts of the central nervous system are deficient.

This boy was a terror in school, causing constant scenes in the classroom, refusing to submit to discipline, committing truancy and petty thefts and finally threatening to kill his teacher with a knife. He was brought to me for examination and treatment. The diagnosis indicated a slight formative disturbance of the brain and gonads plus emotional instability due to a pluri-glandular involvement. He was put on treatment, with the result that his teachers and parents soon reported very marked improvement in the boy's conduct and work. However, his parents, after a short period of treatment, permitted him to stay away from the clinic and cease medication, with the result that he was shortly in the same condition as before. Being then returned and treatment resumed, the functional disturbance was corrected. His violence has subsided and he does his work as well as can be expected of a mentally retarded type.

It would be possible to pile up innumerable cases of this kind, but the object of showing that abnormal behavior is caused by disturbance of the glands and neuron centers and that the trouble may be corrected through treatment of the endocrines, is achieved without tediously multiplying examples. Neither does it require any feat of imagination to understand the connection between these grave or dramatic cases of malfunction in the central nervous system and the less obvious peculiarities of conduct and character in mankind up and down the social scale.



PLANTS OF THE MOSS-LEAVED FERN

FIGURE 8. The tuft in the pot at 1 is a single plant of the moss-leaved fern, consisting of several forking leaves, all interlaced together. The three plants in the pot marked 2 have recently been transplanted, having been taken from a leaf where they originated viviparously (see Figures 11-13). A single pinna of the Boston fern is shown to give an idea of their small size. At 3 is shown a reverting plant of *trevilliani*. All five leaves are of different types of reversion.

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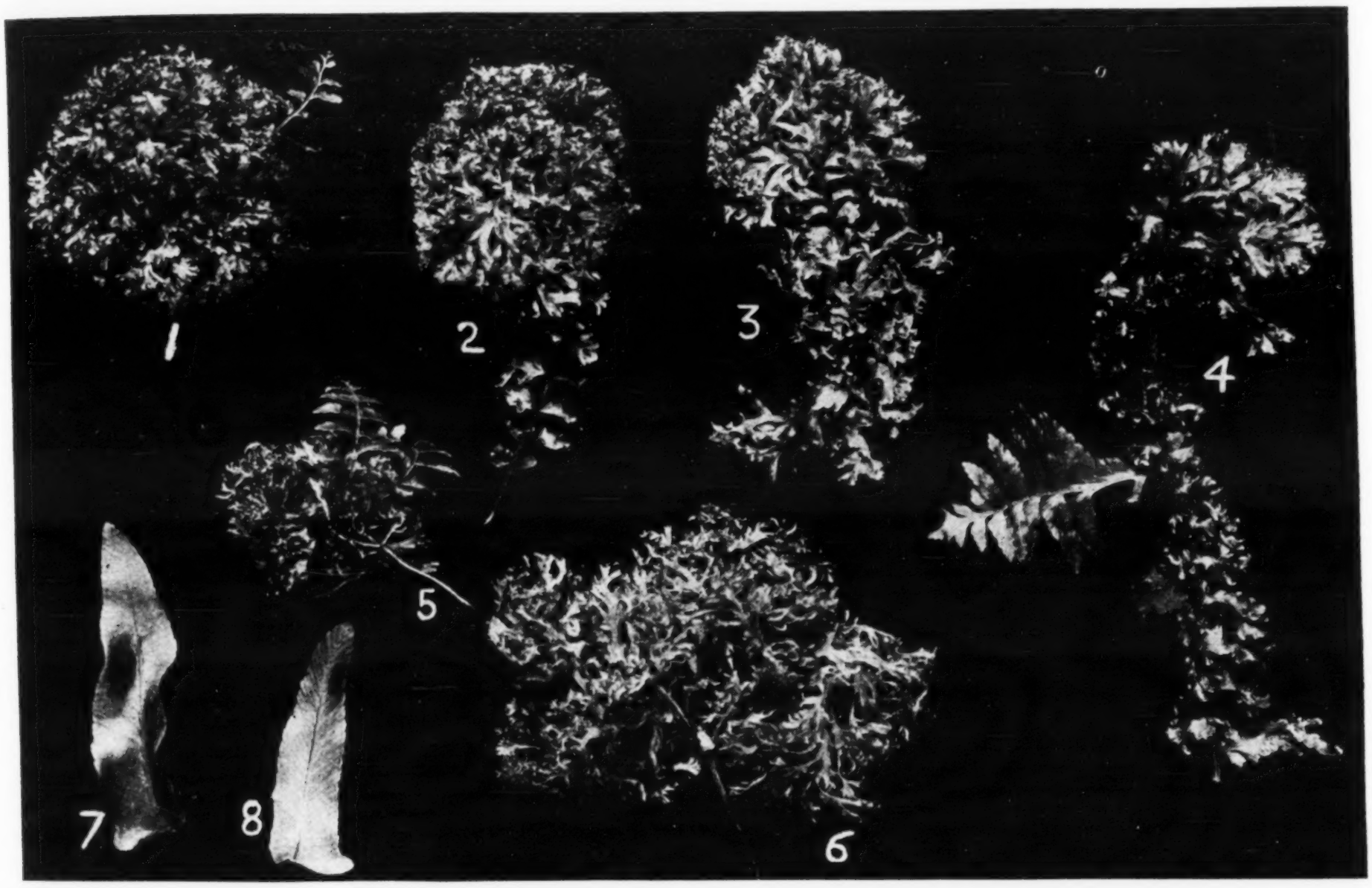
THE MOSS-LEAVED FERN

Nephrolepis Trevilliani, a Remarkable New Sport in the Boston Fern Series

R. C. Benedict

Brooklyn Botanic Garden, Brooklyn, N. Y.



VARIATION IN FRONDS OF THE MOSS-LEAVED FERN

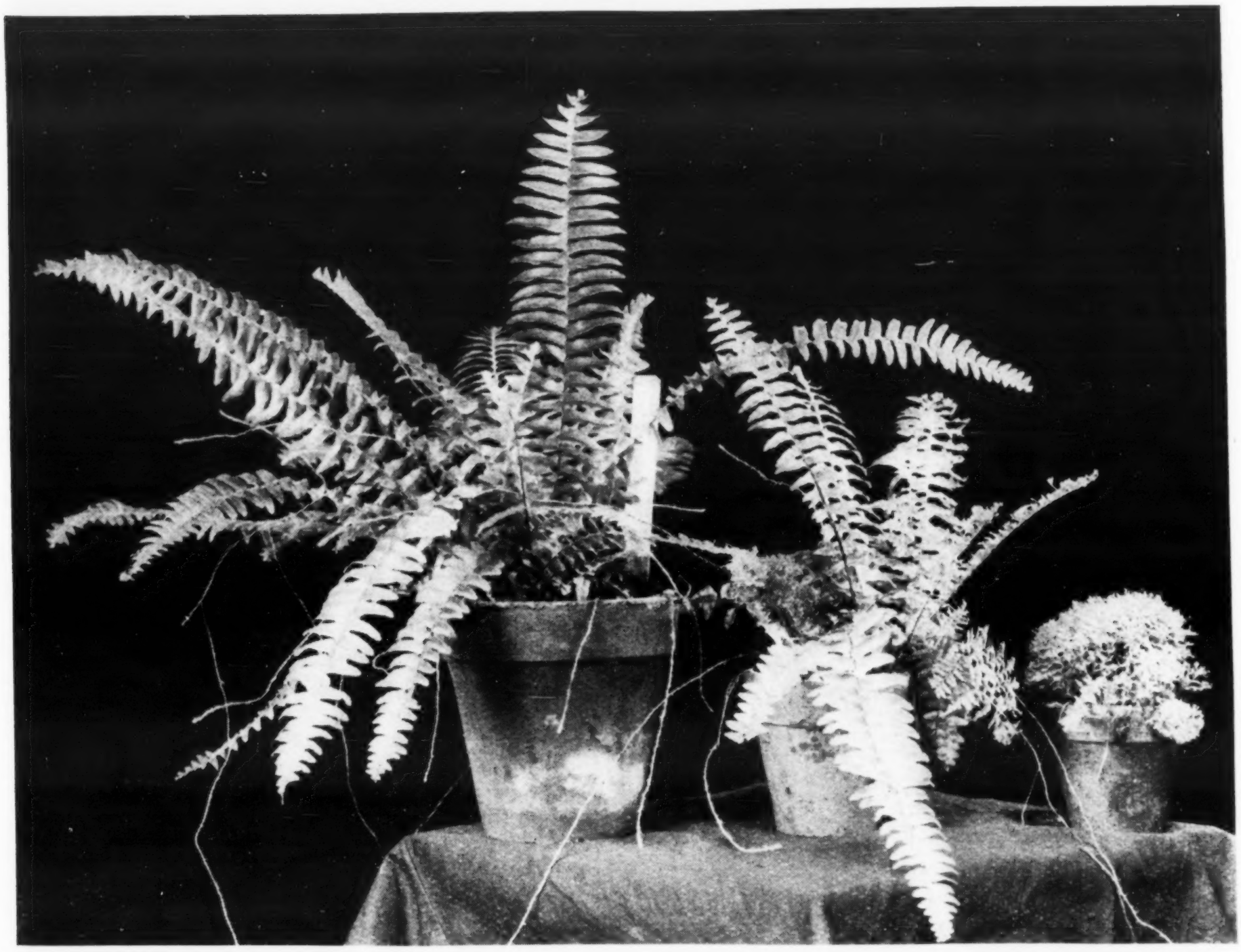
Figure 9. Numbers 1, 5 and 6 are typical densely plumed leaves of *N. trevilliani*, almost spherical in form. In 1 a single lobe has reverted to the plain pinnate condition. A young reverting plant is arising viviparously from leaf 5. Leaf 6 shows the primary branching of the rachis. The forking of this leaf is a little more open than usual. Leaf 2 is once-pinnate at the base, and the segments of 3 and 4 are broader than is typical, and not so finely divided. A single pinna of 4 is typical of *elegantissima-compacta*, one of the progenitors of *trevilliani*. A plain pinna of the Boston fern is shown at 7, and beside it a completely reverted leaf of *trevilliani*.

THE fern variety treated in the present article has already been described and partly illustrated in an earlier paper.* In the ensuing fourteen months there has been considerable opportunity for further experimental culture, and some of the later observations are here presented, together with additional illustrations.

Referred to in the earlier article as the "crested lace" variety, indicative of its forking and finely divided character, the new variety has since been given a definite name, *Nephrolepis Trevilliani*, after Mr. J. T. Trevillian, who has had charge of the commercial fern cultures for F. R. Pierson, Tarrytown, for more than twenty years. As

Genetics 8:75-95. January, 1923.

single pinna of the Boston fern is shown at 7, and beside it a completely reverted leaf of *trevilliani*. types of reversion.



TYPICAL MOSS-LEAVED FERN AND REVERTING DERIVATIVES

FIGURE 10. The small plant at the right, is a fully developed specimen of the new viviparous variety, *N. trevilliani*, growing in a three-inch pot. The tuft probably contains six to eight leaves inextricably woven together by the interlacing of their interminably forked segments. Grown in good light, such a plant presents the appearance of a soft green pin-cushion, or a tuft of soft moss. The plant at the left consisted at the time the photograph was taken, only of once-pinnate leaves, and was considered to be a stable revertion. It originated as a bud from a typical tufted leaf (No. 5 in Figure 2). After the photograph was taken the plant was set out for propagation during the summer of 1923. It then showed some instability, as some of its runner progeny manifested more or less double division, but no typical *trevilliani* plants were produced. It is probable that a completely stable once-pinnate form could be selected. The third plant in the picture was marked an "unstable revert," a characterization justified by its progeny, which showed all degrees from the typical crested lace division to the simple pinnate type. In this respect *trevilliani* shows the same reversion characteristics as the other vegetative varieties of the Boston Fern.

a commercial variety, the new form is scarcely of importance. Scientifically it is remarkable as presenting for the first time the combination of the lace type of division, three to four times pinnate, together with the cresting or forking of its leaf divisions of all degrees. Even more interesting, however, is its manifestation of a feature entirely new, not only for all the multiplicity of Boston fern sports but for the whole genus Nephrolepis as well. This is found in the fact that it is capable under certain conditions of giving rise to new plants directly from its leaves, instead of only from the runners or stolons.

Trevilliani is the smallest of all the series of Boston fern sports, forming, when full grown, merely a soft green tuft about three inches high, of hair-like forking green filaments, individually suggesting moss or seaweed rather than fern leaves. (Entire plants are

ORIGIN OF NEW PLANTS OF THE MOSS-LEAVED FERN

FIGURE 11. The illustration shows a single plant of *N. trevilliani* with three leaves. These are represented mainly by their stipes (stems), most of the green foliage having withered and dropped. Perhaps partly because of the loss of the normal leafage, each of the three is giving rise to several new bud plants, which can be seen developing well above the soil, and are indicated by the three arrows. A strong tendency to revert is evident on the part of the new plants, others typical of the variety are more or less obscured by the more vigorous reverting plants. Viviparous production of new plants directly from the leaves is found in none of the other Boston fern varieties, nor elsewhere in the genus Nephrolepis.

shown in Figures 8 and 10). If this tuft is pulled apart, the separate leaves may appear as spherical masses of green, borne on short wiry reddish petioles.

For the purposes of exact identification and genealogy, this variety may be given its complete series of names, viz: *Nephrolepis exaltata bostoniensis Piersoni elegantissima-compacta elegantissima-compacta-cristata Trevilliani.* It is thus indicated as a fourth generation sport from *bostoniensis* in a series through which its own unique division characteristics have been gradually approached. The progressive steps in its origin, together with the increments of leaf modification attained in each step may be indicated in connection with the name of its ancestral forms: (1) *bostoniensis*, tall, once pinnate; (2) *Piersoni*, tall, twice pinnate; (3) *elegantissima-compacta*, half dwarf, twice pinnate, pinnatifid, ruffled; (4) *elegantissima - compacta - cristata*, half dwarf, twice pinnate pinnatifid, ruffled, crested; (5) *Trevilliani*, dwarf, three to four times pinnate, crested. The last form is almost certainly ruffled like its progenitors, but the tangled nature of a typical leaf and the narrowness of single segments makes ruffling impossible of certain detection.

Trevillian's interest in the variation of the Boston fern series and his keenness of observation, have resulted dur-

TWO LEAVES OF THE PLANT SHOWN ON THE PRECEDING PAGE

FIGURE 12. On the left is the middle leaf of the plant in Figure 11. Note the viviparous plant arising from the first fork of the leaf, with the normal foliage of the parent leaf developing further up. At the right is shown the left-hand leaf in Figure 11, with the stipe (below) broken away from the young plant which has developed from it. The plant consists of six small leaves, one completely reverted, together with two short stolons (runners).

ing the last twenty-five years in the discovery and introduction to the florists' trade of the large number of Pierson varieties. Many of these are of great distinction and value, beginning with the most famous and important of all the division types, the original *Piersoni*. In addition to the varieties which have received the distinction of horticultural names, he has noted and tried out scores of other forms which have proved either insufficiently distinct from known types, or else deficient in horticultural value. Fortunately, from the scientific standpoint, his interest has extended beyond the purely commercial side, and he was quick to realize the intrinsic interest possessed by the variety dealt with in this paper.

Just why this form should show the condition of viviparity (reproduction from leaves), in addition to its complex division type is impossible to say. Whether leaf-budding is linked with the crested lace condition, or whether this represents an additional progressive step in variation cannot at present be determined. The occurrence of new varieties distinguished either by cresting or by lace division has not been uncommon in the Boston fern series, although they have appeared heretofore only in separate forms, but this production of new plants directly from the leaves is, as already noted, unique in the genus Nephrolepis.

The appearance of new varieties distinguished in part by viviparity has been reported in at least one other genus, *Phyllitis scolopendrium*, of which large numbers of forms have been raised by English horticulturists.

In its growth and further variation,

NEW PLANTS ORIGINATING FROM THE LEAVES

FIGURE 13. This is the plant shown in Figure 11, with the remaining leaf still attached (see Figure 12). The vertical stalk is the leaf petiole, its smooth, angled stem distinguishing it from the scaly, terete stolons, or runners. Two new plants are plainly visible, with their trailing stolons. Below is the old stem, with the numerous broken petioles of former leaves.

as watched now for a year and a half, *Trevilliani* seems to follow exactly the lines already described for the other vegetative sports of the Boston fern.† Its progeny, whether from stolon or leaf bud, appear predominantly typical of the parent form, though reverting types are more frequent than in some of the division varieties. In these reverting plants parts of leaves or whole leaves often give rise to forms suggestive of several of its ancestral varieties. Thus in the illustrations may be seen suggestions of *bostoniensis* in the once pinnate reverts, of *elegantissima-compacta* in twice pinnate pinnatifid portions, and of intermediate conditions.

Unstable reversions from *Trevilliani*, presenting a wide variety of leaf forms, are shown in the several illustrations. It is uncertain whether any really stable once-pinnate sports have yet been detected. (See caption under Figure 8.) Doubtless, however, with the cultivation of a large number of young plants, one could obtain a wide variety of stable forms, some possibly of commercial value. It is hard to conceive of the appearance of any new progressive sports in this series. *Trevilliani* itself grows and reproduces rapidly, but is so sensitive to an excess or deficiency of moisture that any further intensification of its characteristics seems impossible.

A Study of Musical Talent

ZUR VERERBUNG UND ENTWICKLUNG DER MUSIKALISCHEN BEGABUNG, by VALENTIN HAECKER, Professor of Zoology at Halle, and THEODOR ZIEHEN, Professor of Philosophy at Halle. With 3 illustrations. Pp. 186. Leipzig, 1922, Verlag von Johann Ambrosius Barth.

This study is based on 1,100 questionnaires comprising more than 5,000 individuals. It has therefore all the defects of the questionnaire method. Those answering the questions were asked to estimate the degree of musical talent of each individual studied, and on the basis of this and other data the subjects are divided into five classes, ranging from absolutely unmusical up to very talented. But it is certain that no two persons would have the same standard of judgment, in making these estimations; hence the data are not easily comparable. The data are minutely analysed, and it is concluded that in general the inheritance of degrees of talent is Mendelian. While musical talent appears in some children before they have learned to talk, it is reported to be most likely to develop at the age of puberty. An apparent tendency toward inheritance in daughters more than in sons is probably to be explained as the result of greater training. The authors properly disclaim any idea that their work is to be accepted as final. It does, however, contain many interesting case histories. P. P.

†*Bull. Torrey Club* 43:207-234. Je. 1916. *Am. Jour. Bot.* 9:140-157. March, 1922; *Genetics* 8:75-95. January, 1923.

TWINNING IN BRAHMA CATTLE

Free-Martins and Identical Twins Appear to be Found in This Species, as in European Cattle

JAY L. LUSH

Texas Agricultural Experiment Station

TWIN BRAHMA BULLS APPARENTLY IDENTICAL

FIGURE 14. Identical twins are very rare among European cattle, and it is of interest to find a pair of Brahma bulls that appear to be identical. Brahma cattle are a different species from European breeds, and it is not known how common such twins are in the native habitat of these cattle.

THE great majority of the cattle of the United States are of European origin; in fact all the improved breeds except the Holstein-Friesian and Brown Swiss had their origin in the British Isles. All these European cattle are classified by systematic zoologists as belonging to the species, *Bos taurus*. There are a few cattle in America, however, which are descended from the cattle of India, considered by zoologists to be a separate species, *Bos indicus*. Visitors to the menageries and zoological gardens know them best under the name of zebus, while the practical cattle men of the coastal plains along the Gulf of Mexico refer to them as Brahma or Brahman cattle.

The menagerie specimens are usually very small and have no significance for the agricultural development of this country. A few individuals of the larger breeds of Brahma cattle have been imported from time to time in the past for crossing on the native cattle of the tick-infested, almost sub-tropical regions bordering on the Gulf of Mexico. This cross has met with considerable success in that region and, although there are very few purebred cattle of this species on the ranches and farms of the United States (probably less than one hundred head altogether), there are many hundreds which are three-fourths Brahma or more, and literally tens of thousands which are at least one-fourth Brahma.

SACRED CATTLE OF INDIA IMMUNE TO TICK FEVER

FIGURE 15. Pure-bred Hindu cattle, and hybrids of this species with European cattle are immune to tick fever, making them of great value in the thick-infested regions in the Southern states. There are very few pure Brahma or "Zebu" cattle in the United States, but there are tens of thousands of animals having enough Brahma blood to enable them to thrive in the thick-infested regions.

Most of these cattle are in Texas, with a considerable number in Florida and Louisiana and a few are scattered in other states.

Bos taurus and *Bos indicus* cross readily and the cross is fertile in the first hybrid generation and in all succeeding generations. There is no evidence of sterility, which usually results from inter-specific crosses. Those who attach a great deal of importance to inter-specific sterility as being *fundamental* would do well first to explain the cases of inter-specific fertility before regarding the sterility of crosses as anything more than the *usual* result. It seems perfectly possible that the sterility of inter-specific hybrids may ultimately be found to be due to differences between the species in the number or shape of the chromosomes, or in the nature of the genes which the chromosomes carry, such that it is impossible, or at least very rarely that a gamete can be formed which will contain the full complement of genes which are necessary for proper development.

On a recent visit to several of the ranches where Brahma cattle are raised, the writer observed two cases of twinning which are of interest on account of the taxonomic difference between Brahma cattle and ordinary cattle.

The first observed was a pair of yearling bulls which were apparently identical twins, on the ranch of Mr. A. P. Borden at Mackay, Texas. They were between three-fourths and seven-eighths Brahma, the other ancestry being grade Hereford. The Hereford inheritance is evident in the brockled face and it is the remarkable similarity of the brockling which first attracted the writer's attention and made it seem likely that they really were identical twins. The very minute differences which do exist in the white spotting on their heads and throats are less than might be expected with a character like white spotting, even when the

heredity is identical. Wright* has shown that the phenotypic degree of spotting in piebald guinea-pigs may vary widely even within a family so intensely inbred that it is practically a pure line. In the same way, we would naturally expect the brockling and limits of the Hereford white color pattern to vary even between individuals of the same genotype, as truly identical twins are. Except for the minute variations in the spotting, these bulls could not be distinguished from each other. There was no other evidence to prove that they were truly identical twins.

Gowen† and Little‡ have shown that identical twins are very rare in *Bos taurus*, but Lillie has published embryological evidence strongly pointing to the existence of one such case. The manager of Mr. Borden's ranch stated that they had had four pairs of twins in three years from their herd of cows, which range from three-fourths to seven-eighths Brahma. This was a little less than one per cent of the calvings.

The second case of twins observed carries with it an especial interest because it tends to prove the existence of free-martins in *Bos indicus* as well as in *Bos taurus*. This case was on the ranch of Mr. Jacob Reitz, El Campo, Texas. The twins had been a male and a female but only the female was in Mr. Reitz's possession at the time. She was five years old, had never produced a calf, and, while not exactly masculine, looked much more like a steer about the head and neck than like a cow. Otherwise she appeared quite normal. Presumably the case was a "free-martin"; that is, a masculinized heifer born twin to a bull. Such heifers are nearly always sterile in *Bos taurus*. The free-martin does not appear to exist, or at least is rare, among twins in horses, sheep, goats, and other mammals, and it would be interesting to know how widespread its occurrence among the species of Bovidae is. This account is admittedly not absolutely conclusive, both because of the lack of complete anatomical evidence that this cow really is a free-martin, and because of the possibility that the *Bos taurus* ancestry might have been responsible for the production of the free-martin if she actually was one. The supposed free-martin was said by her owner to be about five-eighths Brahma. It would be interesting if information could be obtained as to whether free-martins occur among pure *Bos indicus*.

*Wright, Sewall. The Relative Importance of Heredity and Environment in Determining the Piebald Pattern of Guinea Pigs. *Proceedings of the National Academy of Sciences*, 6:320-332. 1920.

†Gowen, John W. Identical Twins in Cattle. *Biol. Bull.*, Vol. 42, No. 1.

‡Lillie, F. R. Supplimentary Notes on Twins in Cattle. *Biol. Bull.*, 44:47-78. 1923.

FROST INJURY CAUSE OF ODD ABNORMALITY IN IRIS

FIGURE 16. The flowers of *Iris trojana* are normally borne on three-foot stems, but a temperature of 12° F. just after growth had started in the spring produced this abnormality. The fact that such profound deviations from the normal can be produced by changes in temperature should be of especial interest to students of variation and heredity. Is it possible that such a phenomenon might have a cytological basis—part of the chromosomes in some of the cells being killed or their arrangement changed by the low temperature encountered just after growth had commenced?

FROST INJURY IN IRIS AND DIERVILLA

J. Marion Shull

U. S. Department of Agriculture

ASIDE from the serious effect upon commercial fruit and truck growing it appears that but slight attention has been given to the subject of frost injury in general and its various manifestations as shown in wild and ornamental species. Too few of the observations made have ever been placed on record to result in any considerable body of literature on the subject and doubtless many of the responses of plant life to freezing temperatures and to fluctuations incident thereto have been passed by as "freaks" or labeled "teratological" or have momentarily engaged the attention of the geneticist, the while the correct interpretation has been missed.

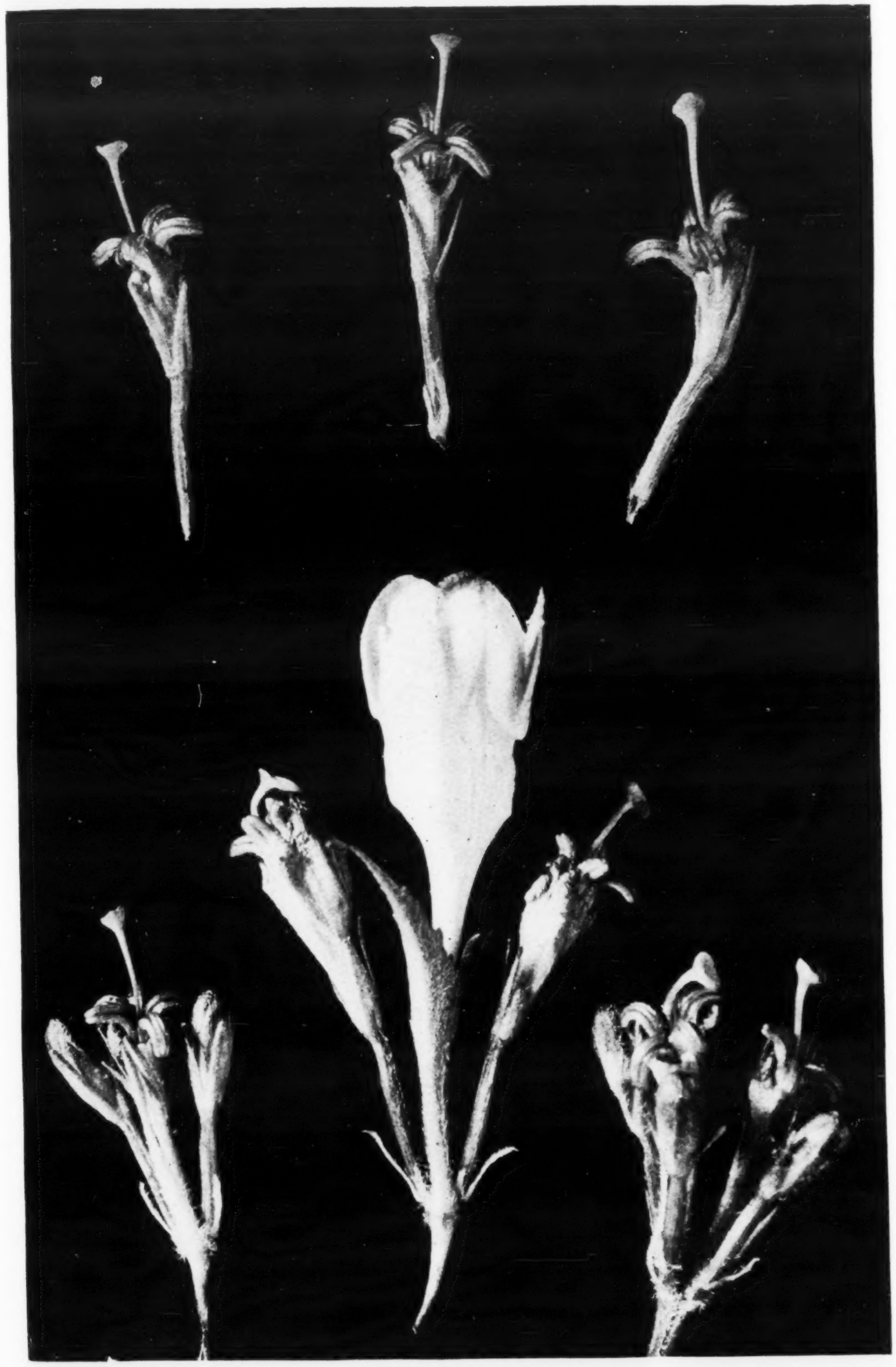
In the instances here reported, the tall bearded iris and *Diervilla coræensis*, there are found very pronounced modifications as the result of quite exceptional temperature changes. In the general region including the District of Columbia, the spring of 1923, up to April 1, might be looked upon as about normal. Phenological observations up to that date indicated the advancement of the season as varying little from the average of a number of years so that as to vegetation in general there had been some slight movement but no excessive or abnormal development. Then on the morning of April 1, following a night of sustained cold, the temperature fell to a minimum of 12° F. killing practically all new foliage growth on such early things as quinces and roses. Iris foliage was frozen stiff and upon thawing showed some browning, but most of the leaves recovered and gave little indication of permanent injury, the fans developing about as usual. But as the time for blooming approached it became apparent that certain varieties would produce very few flowering stems and that probably all varieties would show some diminution of bloom. On investigation of terminal buds that ordinarily should have bloomed, the blighted inflorescence would be found, showing that shy blooming was not due to failure to form buds the preceding autumn.

Now mere suppression of bloom, due to freezing, would hardly be worthy of special note, notwithstanding the fact that in twenty years of experience with this perfectly hardy ornamental no serious loss of this kind had ever been observed, but the chief interest lies in the response where the damage fell something short of complete killing of the nascent inflorescence. In some instances the flowering stems were produced to varying heights and terminated in a head of partially developed sheaths and spathe-valves, barren of flowers or occasionally bearing a single bloom, sometimes of great size, the plant having responded to disbudding by the frost just as roses and chrysanthemums do when disbudded by the gardener to produce exhibition blooms. In other cases hardening of the stem tissues had taken place and interfered with subsequent growth, resulting in transverse crackings near the base and because of this the blooming stems were easily snapped off by the winds, or sometimes the cracking would be longitudinal, but in either case these lesions provided ready means of entrance to a parasitic organism so that many of these defective stems later succumbed to the rhizome rot.

But the strangest manifestation of all is seen in the accompanying illustrations, showing *Iris trojana*, which normally bears its flowers on three-foot stems. Here the stem development has

STEMLESS BLOOM DUE TO FROST INJURY

FIGURE 2. This is the same flower shown in the preceding picture, but with the leaf-bases removed. The flower is nearly normal, but frost injury prevented the development of the three-foot stem characteristic of the variety. From Iris garden of the author, Chevy Chase, Md.



PETALS DWARFED, BUT REMAINDER OF FLOWER NOT INJURED BY FROST

FIGURE 3. Flowers of *Diervilla coræensis* exposed to a temperature of 12° F. on night of April 1, 1923. The corolla development of all except the more backward buds has been arrested, but the pistils and stamens—the most delicate part of the flower—are practically normal.

been entirely suppressed and the one flower to escape is found growing out of the rhizome.

It would appear from the foregoing that the iris inflorescence, which is formed in late summer or autumn* may be divided into several distinct zones with reference to cold-sensitiveness, the most advanced buds probably being the first to suffer, whereas the most backward buds may retain the power to develop even when the underlying tissue at the collar has been completely arrested.

In 1921 considerable frost damage to iris resulted but in that case plant development was several weeks in advance of the normal average and damage was due to a temperature of 26° F. about the last of March, a degree of cold properly to be expected at the time of year. Then the damage, short of actual killing, was manifested largely in injured foliage and malformed and undersized flowers.

Another interesting case of arrested development rather than killing, due to low temperature, is shown in the accompanying illustration of *Diervilla coræensis* which experienced the same temperature conditions indicated above for iris. Many observations of frost injury to fruit blossoms have been made and it is quite generally accepted that the essential organs are very definitely more cold-sensitive than the outer envelope of petals and sepals and are usually killed in the bud while the latter remain uninjured, the ovaries and pistils being the most susceptible parts of the flower. But here in Diervilla we find the corolla not killed but arrested just where it stood when struck by the frost, while stamens and pistil have continued to develop practically as in the unhurt flowers which developed from the more backward buds. *Diervilla rosea* growing nearby was not affected.

The Ancestry of Abraham Lincoln

Among the offspring of cousin marriages, Abraham Lincoln has been hitherto included. On the basis of published genealogies, and a categorical statement in Ida M. Tarbell's *Life of Lincoln*, Professor Johnson and I made the statement in *Applied Eugenics* (p. 333). It now transpires that this view is incorrect. A question raised by Mrs. Ruth Kimball Gardiner brought forth a letter to her from Miss Tarbell, who says that later genealogical research has upset the old view. "It looks now as practically sure—though there is still a loose place in the documents—that Lincoln's parental grandmother was a Miss Herring, of the Shenandoah Valley—an aristocrat, if you please. That is, later research has cut the Shipleys out of the Lincoln side of the family, so we can say with practical certainty that his parents were not 'cousins. . .' I am sorry to say the statement in my book, which is now twenty-five years old, can not be taken as correct. I am also sorry to say that I have had to qualify my statement in my new book. The truth of the matter is that the uncertainty in regard to Nancy Hanks is not yet cleared up, though that of the Lincolns is established with some small loose places. What we must have is a Hanks genealogy. If you know anybody with time, money, and a taste for that kind of digging, do persuade them to get at it. It would be a real contribution to a troubled question."

PAUL POPENOE.

*SHULL, J. MARION, Bud Development in Iris, *Am. Iris Soc. Bul.* 7, *p.* 17-19.

EMBRYO BUDDING OF THE AVOCADO

KNOWLES RYERSON

University of California, College of Agriculture

ONE of the obstacles to be dealt with in the effort to improve the avocado through breeding or through selection of superior seedlings is the length of time required before the value of such new varieties can be determined through fruiting. One of the recently developed methods which gives promise of considerable success in shortening this period has been used by A. R. Rideout, an avocado grower of Whittier, California, in connection with his efforts to improve varieties through seedling selection.

The method consists in using the newly started embryo of a sprouting seed as a bud either in nursery stock or in the limb of a large tree, the resulting top or branch being what in the normal course of events would have been a seedling.

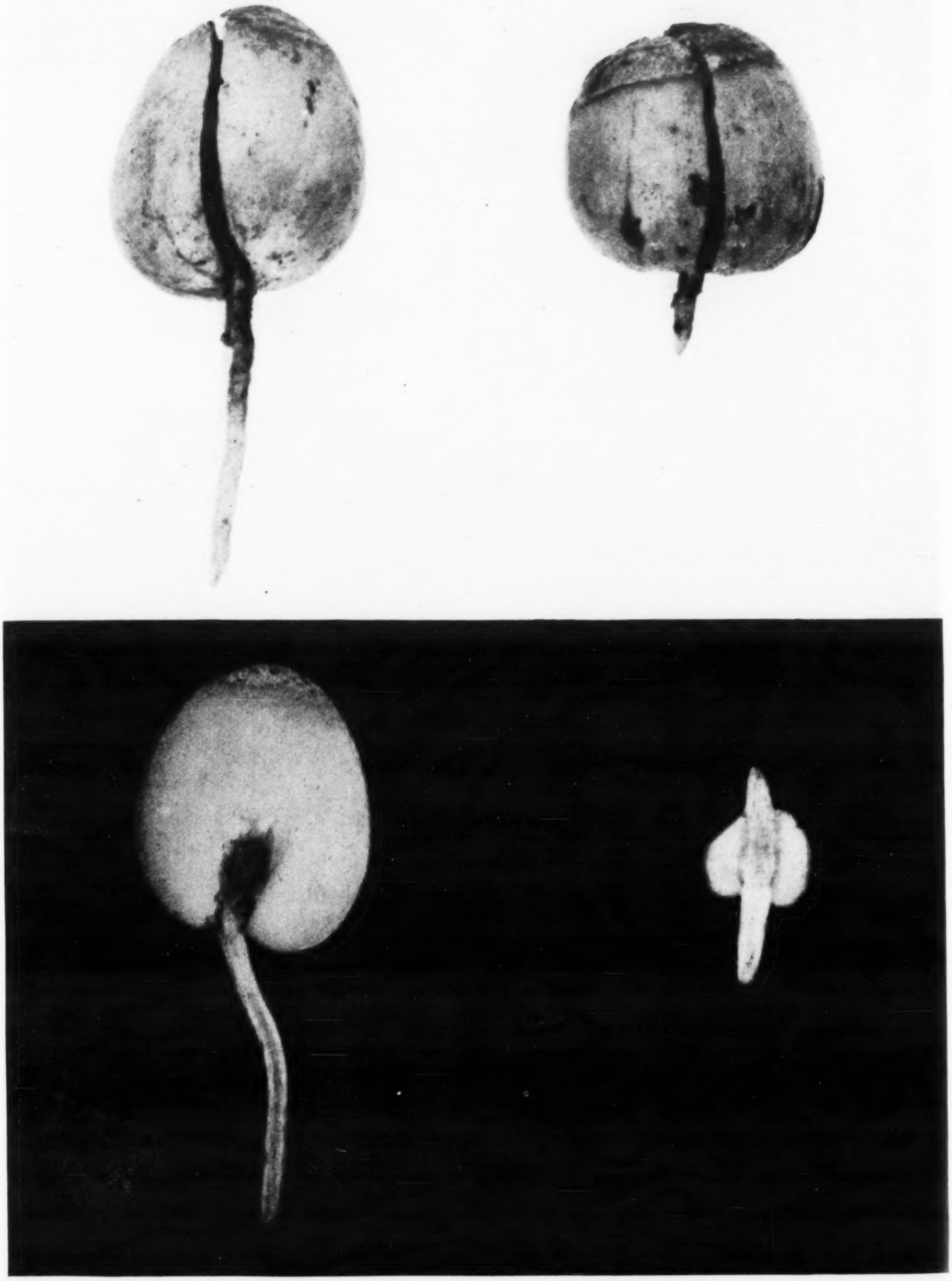
The operation is in itself not difficult. Different stages are indicated in the accompanying illustrations. The seeds are placed in a mixture of half sand and half soil in a seed bed until germination has started (Figure 19). When the first root has grown for a distance of one to one and one-half inches, one of the two large cotyledons is carefully removed with a sharp knife without disturbing the developing plantlet. A sharp cut is made beginning at the base of the tiny shoot and extending through to the root tip. The other half of the seed is sometimes cut away, leaving a small wedge-shaped portion to assist in forcing the rootlet into the incision, or it may be left on entirely (Figure 19, lower half).

The sprouting seed so prepared is inserted in the limb of a mature tree or in a nursery seedling by means of a long "T" incision. If the bark is thick, it is slightly scraped, and then gently lifted along the vertical incision to aid insertion. The tip of the root is inserted at the intersection of the horizontal and vertical cuts and very gently forced down in the same manner as in shield budding until the split radical is well in place, leaving the top of the embryo at or slightly above the cross incision (Figure 20 A).

Strips of budding rubber, an eighth of an inch wide—a product now manufactured for nurserymen—are used to bind the "bud" in place. The wrapping begins from below the vertical incision and proceeds almost to the top of the embryo when the cotyledons have been removed, but should stop half way up on the cotyledon when the latter has been left on (Figure 20 B). A section of dentist's rubber sheeting is wrapped over the area to prevent drying out and to exclude the entrance of water from without until the bud has become attached (Figure 20 C). The rubber sheeting is left on four to six weeks until a union is effected. If the cotyledon has been left on the embryo, it may be removed at this time or be left to drop off of its own accord (Figure 21).

The union occurs about the point of origin of both radical and caulicle. The rootlet eventually dies and drops off as the seedling starts to grow (Figure 22).

This method should save several months at least in bringing seedlings to the fruiting period, and should prove of value in speeding up the results of breeding. It has at least one disadvantage, namely where but one seed is secured from a cross, if the bud should die, the results of the cross would be lost; whereas if the seed were grown in the ordinary manner, the waiting period would be longer, but the risk would not be so great. With ordinary care, however, the operation seems very successful and little loss is experienced. It is not at all difficult and requires only skill on the part of the operator.

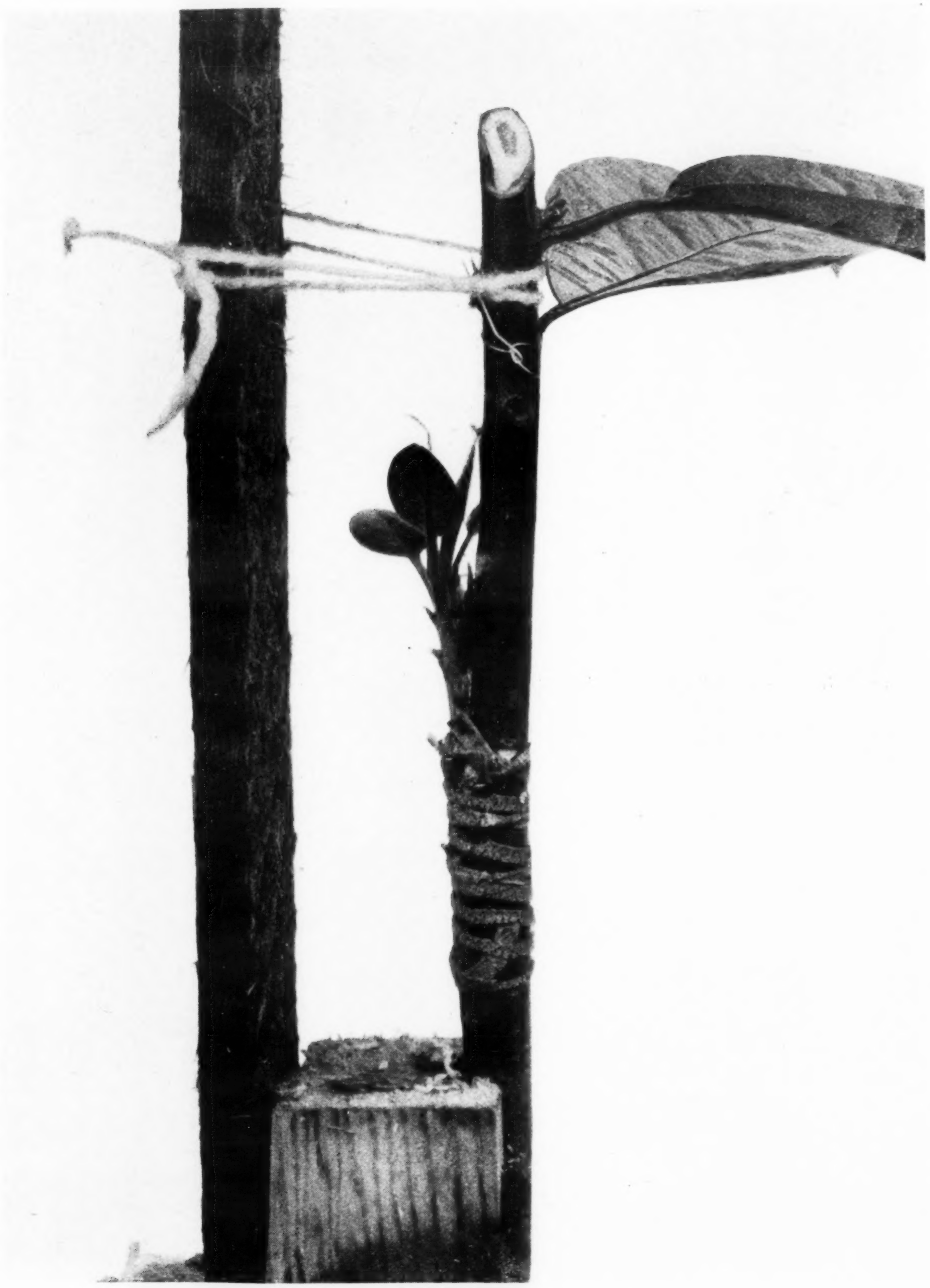


FIRST STEPS IN EMBRYO BUDDING

FIGURE 19. (*Above*) Sprouted avocado seeds at the best stage for embryo budding. (*Below*) The same seeds are shown after they have been prepared for insertion. One cotyledon of the seed on the left has been removed, and the radicle cut through the center from base to tip. On the right is the sprouting embryo from the other seed, with one cotyledon removed, and the other almost entirely cut away. Both methods are used successfully.

FINAL STEPS IN EMBRYO BUDDING

FIGURE 20. The embryos shown in Figure 19 are inserted in "T" incisions in a young avocado plant (A). The buds are then wrapped with budding rubber (B), which is supplied to nurserymen in strips of convenient width. The entire buds, and the stock for some distance above and below them, are covered with dentist's rubber sheeting (C). This excludes moisture, and at the same time keeps the sprouting embryos from drying out before union occurs. The dentist's rubber is left on for four to six weeks. The same method is used in budding the limbs of mature trees.



BUD BREAKING THE RUBBER WRAPPING

FIGURE 21. When grafting rubber is used, rewrapping is not necessary, as the rubber has sufficient elasticity to allow the bud to grow. Note the block of wood inserted between the stock and the supporting stake to keep the former rigid at the surface of the ground.

AT A LATER STAGE OF DEVELOPMENT

FIGURE 22. Union between bud and stock takes place at about the point of origin of radicle and cauticle. Later the rootlet dies and drops off. Its shrivelled remains can be seen hanging just below the base of the shoot. Such a bud can be forced to the fruiting stage sooner than a seedling raised by ordinary methods. Thus the results of breeding experiments can be learned with less delay than would otherwise be possible.

THE ANTIQUITY OF DISEASE

A Review

MOST people have given little thought to the antiquity of disease, perhaps taking it for granted that disease has always existed. Such a view is like the cosmogony of the old woman who asserted that the earth is not free in space, but is supported on a huge rock. On being asked what, in turn, supports the rock, she replied, "Oh, that goes clear down."

In recent years, however, the study of paleontology has made it possible to go a little further than this in an analysis of the subject, and Roy D. Moodie, associate professor of anatomy in the University of Illinois, has brought together most of what is known on the subject in two volumes—a large one[1] for the specialist, and a small one[2] for the general reader.

For the purpose of his study, Dr. Moodie defines disease "as any deviation from the healthy or normal state of the body which has left a visible impress upon the fossilized or mumified remains". This, of course, excludes many types of disease, but for a paleontologist no other definition is practicable, since diseases which leave no trace on the body must be, for him, non-existent.

If it be assumed that disease began with the inception of antagonism between two forms of life, this may have occurred as early as the beginning of life itself. But such scanty evidence as exists indicates that for a long period such antagonism was benign. Dr. Moodie thinks it "probable that the natural immunity of the early animals was sufficiently strong to resist the invasion by any pathogenic organisms in sufficient numbers to produce disease. The breaking down of this immunity may possibly be correlated with the development of senescence among the early races of animals, which reached a climax among the trilobites at about the time we find the early indications of disease among the fossil animals. The breaking down of the immunity, due to the development of race senescence and the introduction of disease, doubtless was of great importance in the extinction of the trilobites, and other great groups of animals which have disappeared from the earth."

A graph is presented to show, in a tentative way, the gradual increase of disease in the world. The mammals of the Cretaceous and early Tertiary periods do not seem to have been so generally afflicted with disease as were the preceding groups of giant reptiles nor as were the later mammals.

"According to present evidences, disease is from the geological standpoint relatively recent in its origin and has afflicted the inhabitants of the earth for only the last one-quarter of the earth's history—that is, for the last 25,000,000 out of a possible 100,000,000 years" . . . "Disease is much more prevalent at the present time than ever before in the history of the world."

It is pointed out, however, that the incompleteness of the geological record makes such conclusions subject to revision. The farther back one goes, the rarer become all relics of life, including evidences of diseased life.

[1] *Palcopathology: An Introduction to the Study of Ancient Evidences of Diseases.* By ROY L. MOODIE, Ph.D. Pp. 567, with 117 plates. Univ. of Illinois Press, Urbana. 1923.

[2] *The Antiquity of Disease.* By ROY L. MOODIE. Pp. 148, with 36 illustrations. Univ. of Chicago Press, Chicago. 1923.

This fact in itself would tend to make it appear that disease becomes rarer in the earlier epochs.

The history of bacteria throws some light on this question. Earlier students knew no more about this history than was summed up in the dogmatic dictum of a well known speculator on the antiquity of microbes:

Adam
Had 'em

The discoveries of C. D. Walcott and others have extended this conclusion by showing that bacteria are to be found in the oldest fossil-bearing rocks of North America—an Algonkian (pre-Cambrian) formation. There is good reason to believe that these earliest bacteria had no relation to disease; they are harmless types engaged in such activities as the formation of limestone. But these primitive Micrococci are not distantly related to bacteria which are responsible for dental caries, and when one comes to the period of the giant reptiles, there is abundant evidence that many of these suffered the tortures of toothache.

One of the unsolved mysteries of evolution concerns the extinction of whole races of animals. To take a single illustration, the gigantic amphibians known as labyrinthodonts, had a relatively short but vigorous period of existence, during which they attained such a wide distribution that their remains are reported from Spitzbergen, Australia, South Africa, Europe, Asia and North America. Then they totally disappeared. Such a disappearance is at present unaccountable. Undoubtedly the causes were multiple. Disease has often been suggested as one cause.

There is no direct evidence to show what part disease played in the extinction of species, but it is interesting to note that several species of tsetse flies of the genus Glossina have been found in the early Tertiary of Colorado, a million years ago. If tsetse flies in that period carried trypanosomes, similar to those which cause "sleeping sickness" in modern Africa, the disappearance of some of the ungulates in the American Tertiary can easily be accounted for.

Remains of primitive man tell the same story of disease that is revealed by the fossils of other animals—indeed, the femur of *Pithecanthropus erectus,* the earliest quasi-human specimen known, shows marked exostoses. Many of the human remains show injuries due to war or the chase, but in the Neolithic there are marked traces of tuberculosis, arthritis, caries, and cancer.

Negative evidence is in some cases equally striking. Few diseases leave more marked effects on the skeleton than does syphilis, yet in all the world there has been found no undoubted evidence of syphilis, in bones dating prior to the discovery of America. It has been commonly thought that syphilis originated in the New World and was carried to Europe after 1492; yet traces of it in the pre-Columbian period are no more to be found in the western hemisphere than in the eastern.

Some diseases seem to have died out altogether at the present day; others reappear from time to time in history, after long intervals of absence, and sometimes show transformations. "Thus the disease known as sweating sickness, the characteristics of which are carefully described by Hecker (1846) for the Middle Ages, has reappeared in modified form during the past two decades in western Europe, after being long regarded as an extinct disease."

The diseases of ancient Egypt are better known than those of any other country during the historical period, not only because mummification has preserved an incomparable lot of material, but because a number of investigators of the first rank have worked on this material. Tuberculosis, appen-

dicitis, cancer, smallpox, pneumonia, arterio-sclerosis, caries, are among the well-attested forms found.

Some of these offer interesting data by which to test modern theories of hygiene. Hardening of the arteries is generally thought of as a particularly modern disease, due to living at too high speed and following wrong dietetic practices; yet Merneptah, the reputed Pharaoh of the Hebrew Exodus, had a marked arterio-sclerosis of the aorta.

Again, decay of teeth has been charged to various deficiencies in the modern diet, yet caries was widely prevalent among the peasants of ancient Egypt, whose diet comprised the things that are now said to be necessary to prevent caries. It is evident that such diseases probably have a racial basis, which goes much deeper than, e. g., eating too much candy, or failure to use the advertised brand of dentifrice.

Turning to the western hemisphere, one finds healthier races, who, prior to the advent of the white man in 1492, were spared some of the worst visitations of disease, such as tuberculosis, syphilis, smallpox, yellow fever, cholera, typhus, scarlet fever, cancer, and rickets. The rapid devastation of these diseases, after they were introduced by the Spaniards, in itself testifies to the fact that the aboriginal population had not previously been exposed to them. The most marked deviations from good health, found in pre-Columbian remains in South America, are such characteristic local infections as those of Verruga and Leishmaniasis.

PAUL POPENOE.

Inheritance of Mental Traits

VERERBUNG UND SEELENLEBEN, Einfuehrung in die psychiatrische Konstitutions—und Vererbungslehre, von DR. HERMANN HOFFMANN, privatdozent an der Univ. Klink fuer Gemuetsand Nervenkrankheiten in Tuebingen. Mit 104 Ab. S. 258. Preis, $2.00. Berlin, Verlag von Julius Springer. 1922.

A book on the inheritance of mental traits is badly needed, but Dr. Hoffmann's effort can only be described as behind the times. While he begins with an account of modern knowledge of heredity, he fails to connect this satisfactorily with his subject. Moreover, his information is derived almost wholly from German sources, and it happens that a large part of the best work in his subject has been done in America. His discussion of the inheritance of talent and genius is particularly weak, Galton being one of his most recent authorities, and he goes to such an extreme, in calling attention to the supposed fact that men of genius have been the offspring of parents with markedly dissimilar characters, as to say: "The great contrast in the polarization of the egg-cells, and the resulting strong fermentive action on the growth and the constitution of the nerve-cells" are thought partly to account for such genius. In his own field, that of psychiatry, he brings together many interesting pedigrees, though his discussion of them can not be taken too seriously.—P. P.

CONTROL OF FLOWERING IN TEOSINTE

Short-Day Treatment Brings Early Flowers

R. A. EMERSON

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ATTEMPTS to force teosinte into flower in mid-summer, in order to facilitate hybridizing it with maize, have afforded considerable information concerning the flowering time of teosinte under diverse conditions. The possibility that some of this information may be of use to others suggests its publication. The paper is, therefore, to be considered as a help in the technique of teosinte and maize hybridization rather than a contribution to the solution of the physiological problems involved.

Early Observations

Some years ago the writer observed that teosinte that germinated in the greenhouse at Ithaca, New York, during December came into flower within a few months, while plants of the same stock started almost any time from March to June did not blossom until October. With the publication of the results of Garner and Allard with respect to the effects of length of day on the blossoming time of various plants, the reason for this behavior of teosinte became apparent.

The first few times that the writer attempted to force teostinte into flower in time to cross it with maize grown out-of-doors, he began the short-day treatment too early or too late for best results. It seemed worth while, therefore, to determine as nearly as possible when the treatment should be begun, how long it must be continued, the degree of darkness of the room into which the plants were placed to shorten the time of exposure to daylight, and kindred matters. The time and facilities available did not permit as elaborate an experiment as desired, but the results, so far as they go, were fairly decisive, at least on certain points.

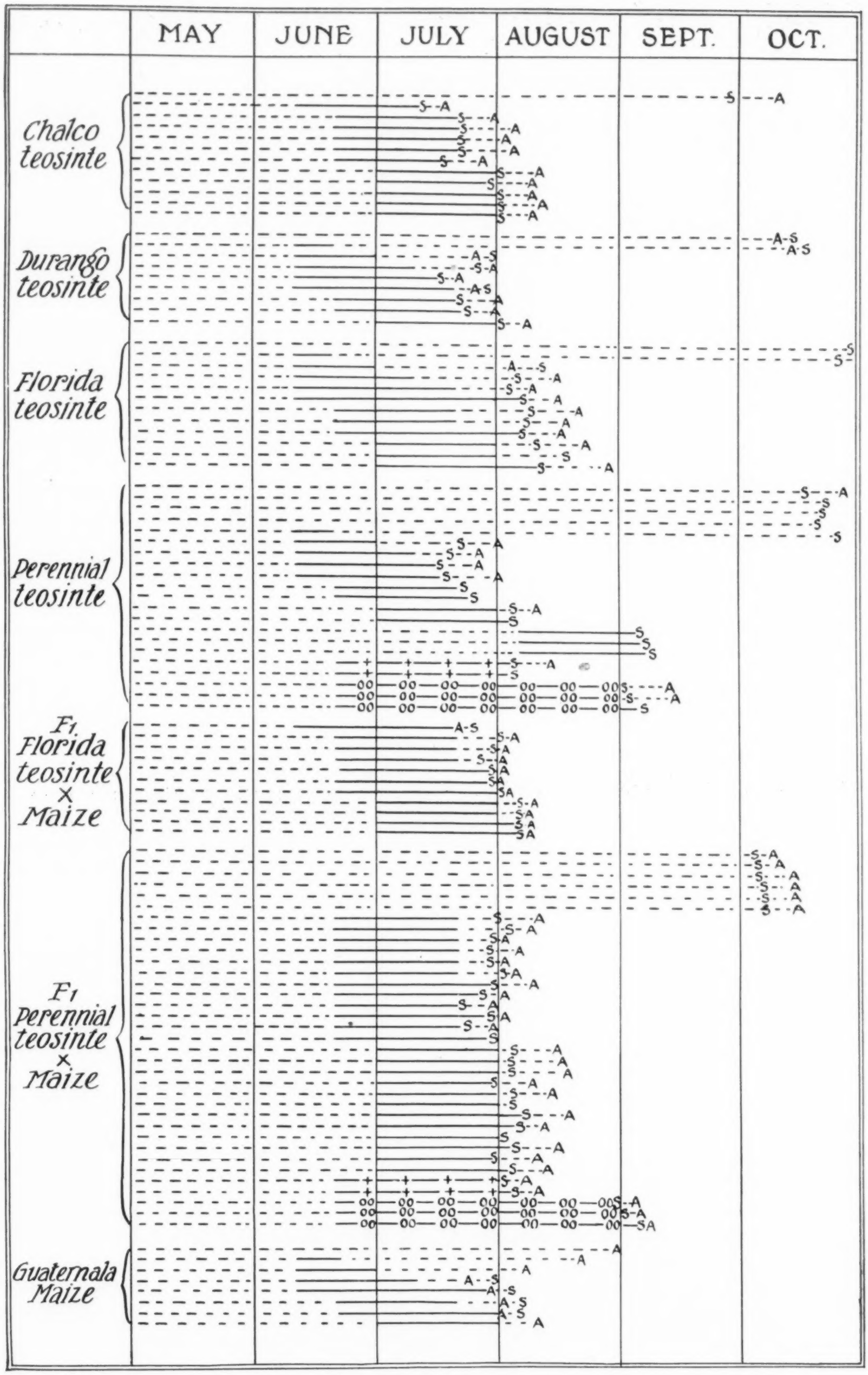
Methods Used

Teosinte plants of stocks originally obtained from Messrs. Collins and Kempton of the United States Department of Agriculture, and plants of maize collected in Guatemala by Dr. Knudson of Cornell University were started in pots in the greenhouse on May 1st, 1923. Germination was fairly prompt in most cases, but no records of the date of germination were made. For perennial teosinte, offsets rather than seeds were used. All plants were kept in the greenhouse, exposed to the full length of day of that season, until June 10th, about a month after germination.

Beginning on June 10th a part of the plants were placed on small trucks, run outdoors at 8:00 A. M. and returned to a darkened room at 6.00 P. M. They were, therefore, exposed to a ten-hour day. Of the remaining plants, some were left in the greenhouse and some kept constantly out-of-doors near the trucks of plants receiving the short-day treatment. At ten-day intervals for a time thereafter, some plants were removed from and others placed in the trucks. The different plants were thus subjected to the short-day treatment at various ages and for various lengths of time.

The room used in this test was darkened by means of several thicknesses of heavy brown paper placed over the glass of the doors and windows. While not perfectly dark, objects in the interior could be made out

*Paper No. 116, Department of Plant Breeding, Cornell University, Ithaca, New York.



SHORT-DAY TREATMENT OF TEOSINTE AND MAIZE

FIGURE 23. Effect of short-day treatment on flowering date of teosinte, teosinte-maize hybrids, and sub-tropical maize. The plants were started May 1 and grown in pots. Each line represents a single plant.

Explanation of symbols:

- - - - - Exposure to full length of day.

——— Ten hours in full light and fourteen hours in a dark room.

+ — + — Ten hours in full light and fourteen hours in a partly darkened room.

— 0 0 — 0 0 Ten hours in full light and fourteen hours under canvas shade.

S indicates date of appearance of silks.

A indicates date of appearance of anthers.

with difficulty when the room was closed. To vary the test, some plants were placed, except for the ten hours of daylight, in a similar room that was partly darkened by green window shades, the glass in the doors not being covered. Still other plants were shaded by means of a heavy canvas enclosing them at the top and sides. The canvas was not securely fastened and often gaped a few inches admitting direct light. No determination of the intensity of light in the several darkened or shaded rooms was attempted. It was found, however, that the light under the canvas at 6:00 P. M. in mid-summer was sufficient to enable one to read fine print fairly readily.

Results of the Tests

The result of the various short-day treatments are perhaps best seen in the diagrams and photographs reproduced here. It is strikingly apparent from the diagrams that in general, plants given only ten hours of daylight blossomed much earlier than those exposed for the full length of day. In case of teosinte and teosinte-maize hybrids the difference was usually more than two months, and for the sub-tropical maize practically one month.

Perhaps the next most striking feature of the diagrams is that ten days of short-day treatment, beginning when the plants were only about a month old, had no effect whatever in hastening the flowering period. It does not follow from this, however, that a ten-day treatment begun later would have been without effect. The experiment gives no information on that point. A twenty-day treatment, on the contrary, was almost as effective as treatment for thirty, forty, or even fifty days.

Of the annual teosintes, Chalco was earliest, Durango next, and Florida last in coming into flower when given no treatment. And the same order of flowering was observed in general for these three varieties when exposed to a ten-hour day. Untreated perennial teosinte plants were slightly later than Durango plants and treated ones of approximately the same season as that annual variety. Hybrids of fairly early stocks of maize with both Florida teosinte and perennial teosinte blossomed, on the whole, somewhat earlier than pure Florida teosinte and slightly later than perennial teosinte.

While there are numerous exceptions to the statement, it can be said in general that the later the short-day treatment was begun the later the plants flowered. This is particularly true of Chalco teosinte, which showed silks in almost exactly thirty days from the time the treatment began, whether it started June 10th, 20th, or 30th. Perennial teosinte flowered in from thirty-five to forty days when treatment was begun June 10th, and in slightly over thirty days when begun June 30th and August 5th. Less prounounced and somewhat less consistent results from beginning treatment at different dates were obtained with Durango and Florida teosinte. In case of hybrids of maize with Florida and with perennial teosinte, silks appeared about five days later when the treatment was begun June 30th than when begun June 20th.

Perennial teosinte plants and perennial teosinte-maize hybrids were the only ones tested in different degrees of darkness. In case of both of these, plants kept in the partly darkened room, except for the ten hours of full daylight, flowered at about the same time as similar plants put in the almost totally dark room ten days later. In other words, they responded to the treatment somewhat less quickly. When treated with the canvas shade, similar plants of these two lots flowered in about seventy days as contrasted to ar average of about thirty-five days for the dark-room plants whose treatment began at the same time. It is interesting to note, however, that even this canvas-shade treatment brought the plants into flower thirty-five to forty-five days earlier than no treatment.

From the information gained in this test, it should be possible, under similar conditions in the future, to start

FLORIDA TEOSINTE AFTER SHORT-DAY TREATMENT

FIGURE 24. The plant at the left was given full daylight throughout the summer except for the ten days from June 10 to 20 when it was subjected to the short-day treatment, ten hours in daylight and fourteen hours in a dark room. It began flowering October 27, fifty-one days after the photograph was taken. Evidently the short-day treatment for so brief a period in an early stage of development had no appreciable effect. The plant at the right was given the same short-day treatment from June 30 to July 30 and came into flower August 10, twenty-seven days before the photograph was taken. Photographs for Figures 24-27 were made September 6, 1923.

PERENNIAL TEOSINTE AFTER SHORT-DAY TREATMENT

FIGURE 25. The plant at the right received the full length of daylight throughout the summer and began flowering October 20, forty-five days after the photograph was taken. The plant at the left was ten hours in full daylight and fourteen hours in the shade of a canvas each day, from June 20 to September 1, when it began flowering, five days before the photograph was taken.

HYBRIDS OF MAIZE AND PERENNIAL TEOSINTE

FIGURE 26. The two plants at the right were in full daylight throughout the summer. The smaller plant grew in a very small pot under rather dry conditions out-of-doors and the larger one in a somewhat larger pot under moister conditions in the greenhouse. The former blossomed October 4 and the latter October 5, about four weeks after the photograph was taken. The plant at the left was given short-day treatment, by use of a dark room, from June 30 to July 30 and flowered August 4, or thirty-three days before the photograph was taken. The second plant from the left was given short-day treatment, by being kept under a canvas shade fourteen hours a day, from June 20 to August 31, when it flowered six days before the photograph was taken.

CHALCO TEOSINTE FORCED INTO FLOWER BY SHORT-DAY TREATMENT

FIGURE 27. The plant at the left was exposed to the full length of daylight of the summer. Its first flowers appeared September 28, or twenty-two days after the photograph was taken. The plant at the right was subjected to the short-day treatment, ten hours in full daylight and fourteen hours in a dark room each day, from June 30 to July 30, and began flowering August 1, or thirty-six days before the photograph was taken. Its tassel was broken off.

teosinte plants and to begin the short-day treatment at dates such that they will flower within perhaps five days, one way or the other, of any date in mid-summer that may be set for their flowering. It should be noted, however, that there is nothing in these tests to indicate how much effect, if any, differences in temperature may exert in determining the flowering time. Ordinarily the earliest of the writer's maize cultures, planted in the garden at Ithaca about May 15th, flower by July 10th to 15th. In the cool summer of 1923, they were ten days to two weeks later than that. Some seasons untreated Durango teosinte plants flower at Ithaca about the first of October. This year they were about two weeks later. Whether plants subjected to the short-day treatment would show similar differences in different seasons is not certainly known, but it seems likely that differences in temperature might have some effect.

There is little in the writer's experience to suggest that differences in cultural conditions have any noticeable effect on season of flowering. During the summer of 1923 Guatemala maize flowered at practically the same time whether grown in the garden or in relatively small flower pots in the greenhouse. Peruvian maize and Durango teosinte failed to show either silks or anthers in the garden at the time of the first killing frost, but the plants had reached practically the same stage of development, tasselling, as had similar potted plants in the greenhouse. Large types of tropical corn are, however, apt to develop few or no ears when grown in small pots and perennial teosinte plants seem more likely to have aborted tassels when they have grown with little vigor.

The Physician's Part

AERZTLICHE HEILKUNDE UND GEBURTENRUECKGANG, by PROF. A. GROTJAHN, DR. MAX HIRSCH, GEH. MED. RAT. PROF. DR. POSNER, OBERREG.-RAT. DR. E. ROESLE, DR. GUSTAV TUGENDREICH. Pp. 54. Price, $0.45. Leipzig, Verlag von Curt Kabitzsch. 1923.

The purpose of this collection of brief papers is to consider what the medical man can do in the practice of his profession to check the falling birth-rate. The subject is discussed from various aspects, but the most important papers are those of Dr. Posner on the treatment of men, and of Dr. Hirsch on the treatment of women.

The chief problem is that presented by sterile marriages, of which, according to current statistics, there are ten to twelve per cent in Germany, fourteen per cent in the United States, twelve and one-half per cent in France. Dr. Hirsch, an experienced gynecologist, thinks the figure for Germany is too low, and that "of 500,000 marriages, which on the average are yearly contracted in Germany, 100,000 are sterile."

From the point of view of mere quantity, it would be desirable to cure the sterility of these matings. From a truly eugenic point of view, the sterility of a large part of them is socially advantageous, and too great success of the medical profession would be unfortunate.—P. P.